COMMUNITY VALUATIONS, PERCEPTIONS, AND JUDGMENTS OF EUCALYPTUS PLANTATION IMPACTS IN UBAJAY AND LA CRIOLLA, ENTRE RIOS, ARGENTINA

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Abstract

COMMUNITY VALUATIONS, PERCEPTIONS, AND JUDGMENTS OF EUCALYPTUS PLANTATION IMPACTS IN UBAJAY AND LA CRIOLLA, ENTRE RIOS, ARGENTINA

The cultivation of tree plantations and subsequent expansion has become prevalent in Argentina over the last two decades due to incentive laws that support the plantation forestry industry. Two towns in the northern Pampas region of Argentina, Ubajay and La Criolla, were selected as study sites for determining community member valuations, perceptions, and judgments regarding the local plantation industry and its effects on the environment and economy. These sites were selected for their differing land use compositions, traditional land uses, and historical employment. Ubajay, a community with significant historical eucalyptus plantation land coverage and forestry employment, and La Criolla, a mixed use community with an economy traditionally focused on citriculture that is currently experiencing a shift to include a greater focus on plantation forestry. Survey data was collected from community members regarding importance of ecosystem services in and around their community, capability of eucalyptus plantations to provide desired ecosystem services, environmental and socioeconomic impacts caused by eucalyptus, and support for the plantation industry. Survey responses were analyzed to determine what aspects of the survey served as the best predictors for support for eucalyptus expansion. To follow up on these findings regarding individual's beliefs about eucalyptus impacts and their malleability based on information provision, Interactive Community Fora were conducted in both communities in December 2017. These Interactive Community Fora provided participants with results from an interdisciplinary research study focused on the environmental impacts of eucalyptus plantation forestry that the two communities participated in over the last five years as well as the opportunity to engage in discourse regarding the local plantation industry and its impacts. It was found that participants in both communities acknowledged negative environmental impacts caused by eucalyptus once exposed to research findings; however, Ubajay was more resistant to acknowledging the severity of impacts than participants in La Criolla. Ubajay participants remained optimistic about socioeconomic effects of eucalyptus and support for the plantation industry, while La Criolla participants did not acknowledge strong socioeconomic benefits, and their support for the plantation industry declined over the course of the Interactive Community Forum. This deeper level of community engagement with scientific

results provides a strong compliment to survey data where the perceptions behind views held toward land use change and its effects may not be as discernible for researchers. Results of this project have implications for the future expansion of plantation forestry in the region and what economic and environmental tradeoffs pertaining to the local forestry industry are acceptable for community members.

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Preface

I plan on submitting both of my research papers, Chapters 2 and 3, for peer-reviewed publication. As such, both chapters have been formatted as stand-alone journal articles. Some redundancy occurs in these chapters due to formatting requirements for Northern Arizona University. I plan to submit Chapter 2 to the Journal of Environmental Values. I plan to submit Chapter 3 to the Journal of Environment and Planning.

Chapter 1. Introduction

Forests provide an array of ecosystem services, the benefits that people obtain from ecosystems, such as provisioning services, including food and fiber, regulating services, such as climate regulation, flood control, and erosion control, supporting services, such as nutrient cycling and crop pollination, and cultural services, such as recreational opportunities (MEA, 2005; Vihervaara, 2012). As global demand for forest products increases (Payn et al., 2015), Argentina has responded by increasing the number of tree plantations and national policies that bolster the domestic forestry industry. These tree plantations are cultivated through planting and/or seeding native or introduced tree species through afforestation or reforestation (FAO, 2006). Land use change in Argentina, particularly in the northeastern portion of the country, has been significant due to the implementation of the Plantation Investment Law, Law N° 25080 (MAGyP, 2008). Enacted in 1999, the law encourages expansion of the country's domestic wood supply and decreases reliance on imported wood and paper products through subsidies and incentives that are advantageous to both new and existing tree plantation enterprises (MAGyP, 2008).

With substantial increase in the demand for forestry products, it is inevitable that plantations will expand, likely into grassland environments (NGP, 2015). This matches a global trend that shows the decline in procuring timber from natural forests (Warman, 2014) coupled with increased extraction from planted forests (Elias & Boucher, 2014; Warman, 2014). Afforestation in grasslands, which has become a common practice worldwide, can modify soils, which can affect plant diversity and overall ecosystem function (Chen et al., 2016).

As of 2015, Argentina contained 33.2 million hectares of native forests and 1.1 million hectares of planted forests, of which 879,000 hectares were managed as tree plantations (NGP, 2015). To reduce pressures on natural forests, plantations must be capable of producing more wood than natural forests in a shorter time period (Howe et al., 2005). While tree plantations represent only 2.5 percent of all forested land in Argentina, they provide 96.8 percent of the nation's timber (NGP, 2015); thus, the Argentine timber market has cultivated a system where minimal tree removal for forest products occurs in native forests, and the vast majority of timber harvesting takes place in plantations. The Argentine government advocates for plantation expansion but also pushes for the protection of natural forests (NGP, 2015).

Argentina is not unfamiliar with land use change; natural landscapes have been significantly altered for different uses since the area endured European colonization (Phifer et al., 2016). Before European colonization of the Argentine Pampas, the region was dominated by semi-nomadic ethnic groups who operated as hunter-gatherers (Fonseca et al., 2013). With colonization came the introduction of cattle ranching, and the prominence of the cattle industry increased the importance placed on the natural resources of the grasslands, alongside creating a cultural identity for the Pampas region that persists into the present (Fonseca et al., 2013). The Pampas region has lost 90 percent of its natural landscape due to these land use changes (Medan et al., 2011).

As is seen in many countries across the globe, plantation forestry is often reliant on a small number of rapidly growing tree species (Calviño-Cancela et al., 2012), which is the case in Argentina with its strong presence of eucalyptus plantations. Eucalyptus was introduced into Argentina well before the creation of the country's encouragement for plantation forestry via contemporary plantation laws. The original introduction of a eucalyptus species into the country occurred in 1857 when *E. globulus* was brought in to provide windbreaks as well as to provide a form of decorative vegetation (INTA, 1995; Sánchez Acosta and Sepliarsky, 2005; Sánchez Acosta, 1999). The industrialization of eucalyptus took several decades to occur after the original eucalypt introduction, with the beginnings of those types of plantations taking place in the Entre Ríos and Misiones Provinces in the 1940s (INTA, 1995). By the early 1990s, the Entre Ríos Department of Concordia had experienced a rapid uptick in land coverage of *E. grandis*, another species of eucalyptus commonly utilized in plantations (INTA, 1995). That region constitutes a portion of the Pampas, the central plain of Argentina, which has a mild climate and fertile soils (Hunt et al., 2017). The Pampas was once covered by grasslands but has experienced significant land use change that has led it to become the most productive agricultural region in Argentina (Hunt et al., 2017). The Pampas and other locales within northeastern Argentina see rapid tree growth rates that provide quick returns on plantation investments, as is seen in the growth rate of 35 m3/ha/year for *E. grandis* in the area (Cubbage et al., 2010; Cubbage et al., 2007). While eucalyptus grows quickly in the region, the planting of native tree species usually provides more suitable habitat for endemic species (Brockerhoff et al., 2013).

The negative environmental effects caused by eucalyptus plantations are numerous, including soil degradation, water resource overuse, and biodiversity loss (Bremer and Farley, 2010; Jobbágy and Jackson, 2004; Phifer et al., 2016). Eucalyptus requires substantially more water than the native grasses and espinal, savanna ecosystems with clumps of small trees, seen in the Pampas, and this additional drain on water resources occurs early on in the plantation's life cycle – Eucalyptus plantations use more water than native grasslands in only two to three years after being planted, and they steadily use more water until reaching four to five years of age, at which point water use continues to increase but at a slower rate (Nosetto et al., 2005). In addition to the increase in water usage, tree plantations also have higher evaporative water losses than native grasslands (Nosetto et al., 2005).

Some Pampas communities with a strong forestry industry, like Ubajay, show favorable support for the industry's economic effects through their reported appreciation for local forestry employment that results in meeting basic needs of residents (Marini, 2016). In contrast, research conducted in afforested Uruguayan grasslands indicated no change in the standard of living for local communities (Carámbula & Piñeiro, 2006). Further, degradation in local employment conditions were observed in these communities experiencing tree plantation expansion (Carámbula & Piñeiro, 2006).

This thesis project is part of a larger research team effort, the Partnerships for International Research and Education (PIRE) project entitled "OISE-PIRE: Sustainability, Ecosystem Services, and Forest-related Bioenergy Development across the Americas." This NSF-funded project has involved over 100 researchers studying bioenergy and its role and effects on ecosystem services and sustainability in six different countries in North America and South America. Research for this project has been conducted over the past five years and is currently coming to a close. This thesis project intends to provide a comprehensive look at the results of the research team focused on one of the study countries, Argentina.

The study sought to combine the data collected in the Pampas communities of Ubajay and La Criolla from resident responses to a survey focused on perceptions toward eucalyptus plantations with information acquired from Interactive Community Fora, a deliberative method that provided participants with information on research findings and actively engaged them in discourse on the local plantation industry (Becker et al., 2003). Survey data was collected during 2014 and 2015;

the questionnaire provided to community members asked participants to provide their perceptions of eucalyptus plantation impacts on the local environment and socioeconomics as well as their perceptions regarding the capability of eucalyptus as a land use to provide ecosystem services (Appendix 1). Survey data was utilized to answer the following research questions:

1. What ecosystem services do residents of Ubajay and La Criolla consider most important for their communities to provide?
2. What are the strongest predictors for support of eucalyptus expansion?

The Interactive Community Fora then built upon the knowledge gleaned from survey data by looking at a baseline of community members' knowledge of plantations effects on the local environment and economy, as well as their acceptability toward eucalyptus as a land use. Information was provided on plantation effects to participants, the opportunity to discuss followed, and judgments regarding plantations effects and acceptability for plantations was reassessed. The fora sought to test the following hypotheses:

1. Community member judgments of environmental effects caused by eucalyptus plantations will become more negative as information about plantation effects is provided to ICF participants.

2. The acceptability of eucalyptus as a land use will decrease as more information about the effects, positive and negative, of eucalyptus as a land use is provided to participants.

Interactive Community Fora were conducted in the two Argentine study sites in December 2017 in order to garner insight about perceptions from community members in two study communities, Ubajay and La Criolla, regarding aspects of the project and to provide the research team's results to the community. Interactive Community Forums provide "a method of social impact assessment that seeks community members' judgements of social impacts resulting from project alternatives in an environmental impact assessment," (Becker et al., 2003). The project also utilized survey data collected from questionnaires in the two aforementioned communities in 2014 and 2015 in order to cultivate an index depicting the valuation of specific ecosystem services and the type of landscape, traditional or contemporary, respondents indicated were best at providing particular services. Traditional landscapes are cattle pastures in Ubajay and citrus

groves in La Criolla, and contemporary landscapes are eucalyptus plantations for both communities.

As plantation forestry is expected to continue to expand in the study region (MAGyP, 2008), and only specific ecosystem services can be provided by any particular land use type (Horne & Ovaskainen, 2001, cited by Horne et al., 2005; Scholte et al., 2015), it is paramount to consider what ecosystem services are most important to residents of communities experiencing significant land use change that results in increased eucalyptus plantation land coverage. Gleaning community members' perception of importance for various ecosystem services is desired as tradeoffs between available ecosystem services will occur, and different land use regimes are capable of resulting in different tradeoffs (Lee et al., 2001; Lee, 2007; Vosti and Reardon, 1997). A variety of variables can affect support for land use change via plantation expansion (Howe et al., 2005; Schirmer, 2007), and determining the factors that predict support in study communities will unearth the characteristics present in a community that support the plantation industry and those that oppose the industry. Determining those predicting characteristics provides an avenue for determining the acceptability of tradeoffs in ecosystem services that are likely to occur with increased eucalyptus plantation coverage.

While eucalyptus causes environmental effects (Bremer and Farley, 2010; Jobbágy and Jackson, 2004; Nosetto et al., 2005; Phifer et al., 2016), some effects may not be well recognized among residents in study communities. Judgments of environmental effects are expected to become more negative as information is provided, as has been seen in previous research showing changed judgments when information is provided to participants (Fishkin et al., 2000). This is important to the research as acknowledgments of the negative environmental impacts and their severity provides us with a way to determine the amount of resistance in study communities to research findings that speak directly to effects caused by the contemporary land use and a dominant employment sector, particularly in Ubajay. As findings about the effects eucalyptus has as a land use are provided to study communities, acceptability is expected to change toward eucalyptus as a land use. As plantations are expected to expand due to forestry incentive laws (MAGyP, 2008), it is imperative to discover whether communities are receptive of government policy that encourages plantation expansion in the face of environmental and economic tradeoffs.

References

Becker, D. R., Harris, C. C., McLaughlin, W. J., & Nielsen, E. A. (2003). A participatory approach to social impact assessment: The interactive community forum. *Environmental Impact Assessment Review, 23*(3), 367-382. doi:10.1016/S0195-9255(02)00098-7

Bremer, L., & Farley, K. (2010). Does plantation forestry restore biodiversity or create green deserts? A synthesis of the effects of land-use transitions on plant species richness. *Biodiversity and Conservation*, 19(14), 3893-3915. doi:10.1007/s10531-010-9936-4

Brockerhoff, E. G., Jactel, H., Parrotta, J. A., & Ferraz, S. F. B. (2013). Role of eucalypt and other planted forests in biodiversity conservation and the provision of biodiversity-related ecosystem services. *Forest Ecology and Management*, 301, 43-50. doi:10.1016/j.foreco.2012.09.018

Carámbula, M., & Piñeiro, D. (2006). La forestación en Uruguay: Cambio demográfico y empleo en tres localidades. *Agrociencia,* 63-73.

Calviño-Cancela, M., Rubido-Bará, M., & van Etten, E. J. B. (2012). Do eucalypt plantations provide habitat for native forest biodiversity? *Forest Ecology and Management*, 270, 153-162. doi:10.1016/j.foreco.2012.01.019

Chen, L., He, Z., Zhu, X., Du, J., Yang, J., & Li, J. (2016). Impacts of afforestation on plant diversity, soil properties, and soil organic carbon storage in a semi-arid grassland of northwestern China. *Catena*, 147, 300-307. doi:10.1016/j.catena.2016.07.009

Cubbage, F., Koesbandana, S., Mac Donagh, P., Rubilar, R., Balmelli, G., Olmos, V. M., . . . Phillips, R. (2010). Global timber investments, wood costs, regulation, and risk. *Biomass and Bioenergy*, 34(12), 1667-1678. doi:10.1016/j.biombioe.2010.05.008

Cubbage, F., Mac Donagh, P., Sawinski Júnior, J., Rubilar, R., Donoso, P., Ferreira, A., . . . Alvarez, J. (2007). Timber investment returns for selected plantations and native forests in South America and the Southern United States. *New Forests*, 33(3), 237-255. doi:10.1007/s11056-006-9025-4

Elias, P., & Boucher, D. (2014). Planting for the future: How demand for wood products could be friendly to tropical forests. Union of Concerned Scientists.

FAO. (2010). Global forest resources assessment 2010. Rome: Food and Agriculture Organization of the United Nations.

Fishkin, J. S., Jowell, R., & Luskin, R. L. (2000). Deliberative polling and public consultation. *Parliamentary Affairs*, 53(4) Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;query=Id:%22library/jrnart/8CT26%22

Fonseca, C., Guadagnin, D., Emer, C., Masciadri, S., Germain, P., & Zalba, S. (2013). Invasive alien plants in the Pampas grasslands: A tri-national cooperation challenge. *Biological Invasions*, 15(8), 1751-1763. doi:10.1007/s10530-013-0406-2

Horne, P., Boxall, P. C., & Adamowicz, W. L. (2005). Multiple-use management of forest recreation sites: A spatially explicit choice experiment. *Forest Ecology and Management, 207*, 189-199.

Howe, G. T., Shindler, B., Cashore, B., & Hansen, E. (2005). Public influences on plantation forestry. *Journal of Forestry*, 103(2), 90.

Hunt, L., Bonetto, C., Marrochi, N., Scalise, A., Fanelli, S., Liess, M., Lydy, M. J., Chiu, M. C., & Resh, V. H. (2017). Species at risk (SPEAR) index indicates effects of insecticides on stream invertebrate communities in soy production regions of the Argentine Pampas. *The Science of the Total Environment, 580*, 699-709. 10.1016/j.scitotenv.2016.12.016

INTA. (1995). Introducción, in: Manual para productores de eucaliptos de la Mesopotamia Argentina.

Jobbágy, E. G., & Jackson, R. B. (2004). Groundwater use and salinization with grassland afforestation. *Global Change Biology*, 10(8), 1299-1312. doi:10.1111/j.1365-2486.2004.00806.x

Lee, D. R. (2007). Assessing environment-development tradeoffs: A developing country perspective. The SAGE handbook of Environment and Society (pp. 181-190). London: SAGE Publications Ltd. doi:10.4135/9781848607873.n12

Lee, D. R., Barrett, C. B., Hazell, P., & Southgate, D. (2001). Assessing tradeoffs and synergies among agricultural intensification, economic development and environmental goals: Conclusions and implications for policy. Tradeoffs or synergies? Agricultural intensification, economic development and the environment. Wallingford, UK: CABI Publishing. doi:10.1079/9780851994352.0451

MAGyP. (2008). Ley 25.080 generalidades.

Marini, V. (2016). The relationship between sense of place theory and perceptions of environmental, social and economic impacts of the expansion of monoculture plantations: A case study of Ubajay, Entre Ríos Province, Argentina.

Medan, D., Torretta, J., Hodara, K., de la Fuente, E., & Montaldo, N. (2011). Effects of agriculture expansion and intensification on the vertebrate and invertebrate diversity in the Pampas of Argentina. *Biodiversity and Conservation*, 20(13), 3077-3100. doi:10.1007/s10531-011-0118-9

Millennium Ecosystem Assessment. (2005). Ecosystems and well-being: Biodiversity synthesis. Washington, DC.

New Generation Plantations. (2015). Argentina, plantations in grasslands.

Nosetto, M. D., Jobbágy, E. G., & Paruelo, J. M. (2005). Land-use change and water losses: The case of grassland afforestation across a soil textural gradient in Central Argentina. *Global Change Biology*, 11(7), 1101-1117. doi:10.1111/j.1365-2486.2005.00975.x

Payn, T., Carnus, J., Freer-Smith, P., Kimberley, M., Kollert, W., Shirong, L., Orazio, C., Rodriguez, L., Silva, L. N., & Wingfield, M. J. (2015). Changes in planted forests and future global implications. *Forest Ecology and Management*, 352, 57-67. Retrieved from DOI: 10.1016/j.foreco.2015.06.021

Phifer, C. C., Knowlton, J. L., Webster, C. R., Flaspholer, D. J., & Licata, J. A. (2016). Bird community responses to afforested eucalyptus plantations in the Argentina Pampas. *Biodiversity Conservation*, 25, 1-29.

Sánchez Acosta, M. (1999). Tecnología de la madera de eucalipto en el mercosur y otros países. *XIV Jornadas for. Entre Ríos*, 1-32.

Sánchez Acosta, M., & Sepliarsky, F. (2005). Tecnología de la madera de eucaliptos colorados: Propiedades – usos – posibilidades. *I Jornadas for. Santiago Del Estero.*

Schirmer, J. (2007). Plantations and social conflict: Exploring the differences between small-scale and large-scale plantation forestry. *Small-Scale Forestry*, 6(1), 19-33. doi:10.1007/s11842-007-9001-7

Scholte, S. K. S., van Teefelen, A J A, & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics, 114*, 67-78.

Silva, C. A., Nielsen, E. A., Abrams, J., Selfa, T., & Diaz, D. (2016). Community perceptions of tree plantation effects on ecosystem services and well-being in Argentina.

Vihervaara, P., Marjokorpi, A., Kumpula, T., Walls, M., & Kamppinen, M. (2012). Ecosystem services of fast-growing tree plantations: A case study on integrating social valuations with land-use changes in Uruguay. *Forest Policy and Economics*, 14(1), 58-68. doi:10.1016/j.forpol.2011.08.008

Vosti, S. A. & Reardon, T. (1997). Sustainability, growth and poverty alleviation: A policy and agroecological perspective. Baltimore, MD.

Warman, R. (2014). Global wood production from natural forests has peaked. *Biodiversity and Conservation*, 23(5), 1063-1078. doi:10.1007/s10531-014-0633-6

Chapter 2. Valuations of Contemporary Land Use, Ecosystem Services, and Eucalyptus Plantation Expansion in Argentine Pampas communities

Abstract

Plantation forestry has gained a dominant presence in the Pampas region of Argentina over the last two decades due to incentive laws that support the plantation forestry industry. This study focused on the towns of Ubajay, a community with significant historical eucalyptus plantation land coverage and forestry employment, and La Criolla, a community with an economy traditionally focused on citriculture that is currently experiencing a shift to include a greater focus on plantation forestry. Survey data was collected from community members regarding importance of ecosystem services in and around their community, capability of eucalyptus plantations to provide desired ecosystem services, environmental and socioeconomic impacts caused by eucalyptus, and support for the plantation industry. Survey responses were analyzed to determine what aspects of the survey served as the best predictors for support for eucalyptus expansion. Beliefs about the social and environmental impacts of eucalyptus, ecosystem services values and perceptions about their provision from eucalyptus land use, income from the forestry industry, and environmental values were all significant predictors of support for expansion of local eucalyptus plantations. To follow up on these findings regarding individual's beliefs about eucalyptus impacts and their malleability based on information provision, Interactive Community Fora (ICFs) were conducted in Ubajay and La Criolla in December 2017. These ICFs provided participants with results from an interdisciplinary research study focused on the environmental impacts of eucalyptus plantation forestry that the two communities participated in over the last five years as well as the opportunity to engage in discussion regarding the local plantation industry and its impacts. The purpose of the ICF follow-up was to determine the effects information provisions and discourse on judgments of environmental and socio-economic impacts caused by eucalyptus and how those judgments affected acceptability judgements of eucalyptus as a land use. We found that participants in both communities acknowledged negative environmental impacts caused by eucalyptus once exposed to research findings; however, Ubajay was more resistant to acknowledge the severity of impacts than participants in La Criolla. Ubajay remained optimistic about socioeconomic effects of eucalyptus and support for the plantation industry, while La Criolla participants did not acknowledge strong socioeconomic benefits, and their support for the plantation industry declined over the course of the ICF. This

deeper level of community engagement achieved through the ICF design provides a mechanism for researchers to provide community members with the best available science and measure changes in judgments after exposure to information.

Keywords: ecosystem services, land use change, eucalyptus, plantation forestry, expansion, support, predictors, Interactive Community Forum

Introduction

Argentine Forestry Industry, Policy, and Impacts

Forests provide an array of ecosystem services, the benefits that people obtain from ecosystems, such as provisioning services, like food and fiber, regulating services, such as climate regulation, flood control, and erosion control, supporting services, such as nutrient cycling and crop pollination, and cultural services, such as recreational opportunities (MEA, 2005; Vihervaara, 2012). As global demand for forest products increases (Payn et al., 2015), Argentina has responded by increasing the number of tree plantations and national policies that bolster the domestic forestry industry. These tree plantations are cultivated through planting and/or seeding native or introduced tree species through afforestation or reforestation (FAO, 2006). Land use conversion to plantations in Argentina, particularly in the northeastern Mesopotamia region of the country, has been incentivized due to the implementation of the Plantation Investment Law, Law N° 25080 (MAGyP, 2008). Enacted in 1999, the law encourages expansion of the country's domestic wood supply and decreases reliance on imported wood and paper products through subsidies and incentives that are advantageous to both new and existing tree plantation enterprises (MAGyP, 2008).

With a substantial increase in the demand for forestry products and federal policy encouraging an expanded forestry industry, it is likely that plantations will expand, especially into grassland environments (NGP, 2015). This matches a global trend that shows the decline in procuring timber from natural forests (Warman, 2014) coupled with increased extraction from planted forests (Elias & Boucher, 2014; Warman, 2014). Afforestation in grasslands, which has become a common practice all over the world, can modify soils, which can affect plant diversity and overall ecosystem function (Chen et al., 2016).

Argentina is not unfamiliar with land use change; natural landscapes have been significantly altered for different uses since the area endured European colonization (Phifer et al., 2016). With

colonization came the introduction of cattle ranching, and the prominence of the cattle industry increased the importance placed on the natural resources of the grasslands, alongside creating a cultural identity for the Pampas region that persists into the present (Fonseca et al., 2013). The Pampas region has lost 90 percent of its natural landscape due to these land use changes (Medan et al., 2011).

Plantation forestry is often reliant on a small number of rapidly growing tree species (Calviño-Cancela et al., 2012), which is the case of Argentina with its strong presence of eucalyptus and pine plantations. Eucalyptus was introduced into Argentina well before contemporary plantation laws. The original introduction of a eucalyptus species into the country occurred in 1857 when *E. globulus* was brought in to provide windbreaks as well as to provide a form of decorative vegetation (INTA, 1995; Sánchez Acosta and Sepliarsky, 2005; Sánchez Acosta, 1999). The industrialization of eucalyptus took several decades to occur after the original eucalypt introduction, with the beginnings of those types of plantations taking place in the Entre Ríos and Misiones Provinces in the 1940s (INTA, 1995). By the early 1990s, the Entre Ríos Department of Concordia had experienced a rapid uptick in land coverage of *E. grandis*, another species of eucalyptus commonly utilized in plantations (INTA, 1995). The Pampas and other locales within northeastern Argentina see rapid tree growth rates that provide quick returns on plantation investments, as is seen in the growth rate of 35 m^3/ha/year for *E. grandis* in the area (Cubbage et al., 2010; Cubbage et al., 2007). While eucalyptus grows quickly in the region, planting of native tree species usually provides more suitable habitat for endemic species (Brockerhoff et al., 2013).

The environmental effects caused by eucalyptus plantations are numerous, including soil degradation, water resource overuse, and biodiversity loss (Bremer and Farley, 2010; Jobbágy and Jackson, 2004; Phifer et al., 2016). Eucalyptus requires substantially more water than the native grasses and espinal, savanna ecosystems with clumps of small trees endemic to the Pampas, and this water consumption occurs early on in the plantation's life cycle. Eucalyptus plantations use more water than native grasslands in only two to three years after being planted due to evapotranspiration, and they steadily use more water until reaching four to five years of age, at which point water use continues to increase but at a slower rate (Nosetto et al., 2005; Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017).

Valuation of Ecosystem Services

Ecosystem services supply "benefits that nature provides to people, and are community or ecosystem-wide, or even landscape-wide attributes," (Petrosillo et al., 2010). The Millennium Ecosystem Assessment, a report that considers the array of values of ecosystems and the goods and services provided by ecosystems for social well-being, places a heavy focus the monetary value provided by ecosystems (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014). In addition to economic valuations, there are ecological valuations, which focus on how ecosystem services affect ecosystem health. Lastly, there are socio-cultural valuations, which look at the importance of ecosystem services to humans that are not considered in monetary terms (de Groot et al., 2010; MEA, 2005; Oteros-Rozas et al., 2013). Socio-cultural values can be defined as "the importance people, as individuals or as a group, assign to" bundles of ecosystem services (Scholte et al., 2015). The inclusion of socio-cultural values is critical to determine which values are deemed important by stakeholders and who finds those values important (Scholte et al., 2015).

Previous research conducted by Raymond et al. (2009) proposes a modified version of the Millennium Ecosystem Assessment, which includes the original provisioning, regulating, cultural, and supporting ecosystem services, and adds a new category, "people-related services." This added category takes into consideration human-built environments, such as plantations, and the economic effects provided by an ecosystem (Raymond et al., 2009). In addition to valuing ecosystem services like land resources, water, biodiversity, and atmospheric provisions, individuals also reported valuing the services provided by built environments and their communities, although land and water resources received the highest valuations among respondents (Raymond et al., 2009). The raw materials garnered in forestry production communities should be considered for the wood and fiber they provide. This living biomass provides physical goods for human consumption as a provisioning ecosystem service (de Groot et al., 2002; Raymond et al., 2009).

There are different ideas surrounding the decision-making process for environmental tradeoffs and how those different ecosystem services are valued (Scholte et al., 2015). The claim has been made that improved environmental quality measures are a "luxury good" only for wealthy nations that can afford to implement environmental quality practices (Lee, 2007). Attempting to

study environmental and developmental tradeoffs often ends with an absence of clear, generalizable information (Lee, 2007). There are, however, identified factors that can play into environmental-economical tradeoffs, including available infrastructure and local labor markets. Also of consideration are the macroeconomic environment and sector policies, land tenure and property rights, and institutional frameworks which all play into the outcomes of specific environment-production-livelihood regimes (Lee et al., 2001; Lee, 2007; Vosti and Reardon, 1997). However, no single solution exists for all environmental-economic tradeoff decisions and values. Instead, a catered, location-specific approach that is supportive and inclusive toward smallholders that allows for production in appropriate ecosystems, mitigates pressure on ecosystems, provides diverse employment opportunities, allows for land tenure security, and policy and institutional reforms that allow for sustainable resource management should be considered (Lee, 2007).

Previous research has indicated that study respondents often report a high level of importance for valuation of all ecosystem services they are asked about (Horne & Ovaskainen, 2001, cited by Horne et al., 2005), making it difficult to determine which ecosystem services are most important to participants. Determining the most valued ecosystem services is critical when considering land use change as specific land uses can only provide certain ecosystem services, not an all-encompassing array of services (Horne & Ovaskainen, 2001, cited by Horne et al., 2005; Scholte et al., 2015). It has been asserted that simple awareness of ecosystem services will lead to higher valuation of those services and increased support for nature conservation efforts (Scholte et al., 2016); however, socio-cultural valuation of ecosystem services is not necessarily present because knowledge and awareness of ecosystem services is present (Daw et al., 2011; Scholte et al., 2015; Scholte et al., 2016). While knowledge of ecosystem services can be a contributing factor to subsequent valuation, how individuals interact with ecosystems influences values placed on ecosystem services as well (Daw et al., 2011; Scholte et al., 2015; Scholte et al., 2016). As community members of Ubajay and La Criolla have different land use compositions and different historical experience with the plantation forestry industry, (Silva, 2016; Silva et al., 2016), a comparison is desired for valuations of ecosystem services between the two communities.

Sense of Place and the Environment

Place has been described as "a center of meaning created from experience" (Tuan, 1980) that is "characterized by the meanings and values that individuals ascribe to it," (Payton et al., 2005). Individuals form meanings and values they attach to specific locations, which cultivates a unique sense of place (Davenport and Anderson, 2005). As the landscape of the Argentine Mesopotamia is increasingly altered from pastures to plantations, does the construction of sense of place change for residents? Past research shows that particular landscape attributes directly affect constructed meanings of sense of place, and these constructions are not only socially based (Stedman, 2003). Place attachment can continue to exist in landscapes as they are altered, but how that attachment is symbolized to the individual can morph as landscapes change over time (Stedman, 2003). Mapping technologies can depict possible risks and negative consequences associated with land use change in specific areas (Brown & Raymond, 2007).

Landscape is a comprehensive concept that includes physical, socio-ecological, and institutional aspects, which are considered with value systems, tradition, and knowledge (Conrad et al., 2011; Setten et al., 2012). In particular, rural landscapes display the "convergence of social and political processes, and social and cultural meanings," (Cheng et al., 2003). These rural landscapes can be identified as socially constructed places that are symbolic of a variety of meanings and an array of thoughts regarding activity types that are appropriate for those respective landscapes (Greider & Garkovich, 1994). Values placed on landscapes may differ depending on the factor one is identifying; for example, values placed on land when considering its aesthetics provides a sensory connection to the landscape, recreation opportunities provide values focused on particular activities, and economic ability through production can lead to economic-based values; these all represent different value types (Raymond et al, 2016). The meanings built around a particular place include not only the natural environment; both natural and cultural aspects that make up a landscape are involved, including people (Forristal et al., 2014; Larson et al., 2013). A sense of place is a multifaceted concept that can be viewed from biological, social, and psychological or experiential perspectives (Farnum et al., 2005; Forristal et al., 2014). According to a 2013 study, seven different variables were identified which aid in developing a person's sense of place: length of time a person stays in a place; location of

residence; where they were born; community involvement; membership of associations; whether they feel respected; and whether they are considered a local (Larson et al., 2013).

Time has also been shown to play a critical role in the development of sense of place, as is displayed in the results of a study conducted in Grand Teton National Park and the surrounding Jackson Hole area. The study unearthed the importance of the physical landscape for the beginning stages of place attachment, while social and emotional connections to a place built over time showed deeper meanings typically placed on a particular location (Smaldone et al., 2008). Researchers discovered that participants felt that their meanings given to certain places expanded over time instead of simply being replaced (Smaldone et al., 2008). Interestingly, the meaning given to places does not have to be divided between local residents and visitors: in the Otways region of Australia, aspects of place attachment and place dependence were similar between the two residents and visitors, leading to the possibility of the concept of home or place not being exclusive to residents of a particular area (Brown & Raymond, 2007). Perceptions related to wilderness, aesthetics, and spiritual connections to a landscape were shown to be the most indicative of an individual's created meaning toward that place (Brown & Raymond, 2007).

Strong emotional ties to particular resources have led to greater levels of concern regarding resources use and management, as well as the increased likelihood of playing an active role in resource management (Williams et al., 1992). Strong levels of attachment to a place can also build a sense of unity between individuals or groups (Payton et al., 2005).

Place attachment that stems from economic gain and/or employment also ties into conceptualizations of sense of place. In previous research conducted in Ubajay, Argentina, residents indicated their appreciation for the employment opportunities and fulfillment of basic needs from tree plantation work (Marini, 2016). Ubajay residents also reported a sense of identity for the town that was based on the dominant local industry, plantation forestry (Marini, 2016). Individuals working in the agriculture industry in similar settings may have drastically different perceptions regarding landscape stewardship, landscape values, and land management actions (Raymond et al., 2016). Raymond et al. (2016) found the majority of large-holders identified with a production-centric view of land stewardship, where values focused on keeping land production high and utilizing traditional farming techniques (Raymond et al., 2016).

Aspects important to one's wellbeing may be telling when considering how an individual constructs sense of place for a particular locale. Larson et al. (2013) found that respondents often indicated the importance of clean air and water to their personal wellbeing, while biodiversity and soil quality were selected by the fewest number of participants as being important (Larson et al., 2013). Participants who placed higher values on environmental wellbeing had typically spent less time in the region and usually lived in coastal areas where access to the Great Barrier Reef is easiest (Larson et al., 2013). Connections to a certain place usually relate to greater importance placed on environmental wellbeing, which can cultivate stronger social connections over time (Smaldone et al., 2008).

Research has been conducted regarding the relationship between sense of place and perceptions of the impacts of land use change (Davenport & Anderson, 2005; Marini, 2016; Schirmer et al., 2008). Land use change has been identified as "change in the area of land used for a particular purpose, change in the number of people employed in different land use industries, change in the way a land use is undertaken, change in local and regional economic activity as a result of changing demand for goods and services, and change in volume and value of goods produced," (Schirmer et al., 2008). Past, present, and future land use changes provide critical socio-cultural value determinants of ecosystem services (Aretano et al., 2013; Carvalho-Ribeiro et al., 2010; Roca & Villares, 2012; Tengberg et al., 2012). Long-time residents of Ubajay, Argentina, reported a feeling of having lost their local customs and traditions due to the influx of newcomers who arrived with customs and traditions of their own (Marini, 2016). These residents also disclosed their perception of increased negative climate effects in the community due to land use change to eucalyptus plantations (Marini, 2016). In Australia, the transition to a land use of blue gum plantations resulted in largely negative perceptions of plantation impacts on the local economy, while perceptions of environmental effects caused from land use change were mixed (Schirmer et al., 2008).

Public Acceptability of Tree Plantations

The success of plantation forestry is dependent upon its biological possibility, economic feasibility, and its cultural adoptability, which must be in line with accepted norms and beliefs in locations where plantations exist (Howe et al., 2005; Schirmer, 2007). Rural areas across the world with tree plantation presence are experiencing social conflict and subsequent debate

alongside the increased expansion of plantations (Anderson et al., 2013; Schirmer, 2007; Williams, 2014). Public acceptability for plantations is a critical factor for public policy and natural resource decision-making (Anderson et al., 2013; Ford and Williams, 2016; Schirmer, 2007; Williams, 2014). Policy without public understanding and support is difficult to sustain (Howe et al., 2005).

Residents from two regions of Australia indicated that plantations, regardless of the products produced, were a significantly less acceptable land use than the traditional land use, agriculture (Williams, 2011). Research in Ireland and Australia has shown that greater levels of social conflict persist when plantations involve large-scale afforestation, while social conflict surrounding plantations is less when the operations involve small-scale afforestation (Schirmer, 2007). While a specific size of plantation is not identified as large scale or small scale, respondents in Schirmer's 2007 research tended to view the difference between different plantation scales as the type of ownership the plantation possesses: Large-scale operations were often viewed as plantations owned by corporations and government agencies, while small-scale plantations focused on individual land-holder ownership (Schirmer, 2007). A preference for smaller scale operations also focuses on a diversified "farm-forestry" system, where a resident landowner familiar with traditional agricultural practices is involved (Schirmer, 2002).

Even when plantations exist on private lands, as is the case with the majority of Argentine plantations, the public is still affected by plantation operations. Specifically, forested environments are commonly viewed as a "societal good" in which activities on these private lands impact the public and their available resources (Howe et al., 2005). Plantations also compete with other land use types; acceptance is greater when lands that are not very productive or that are ecologically poor are transitioned to plantations, while productive agricultural or ecologically sound environments that are converted to plantations receive less public support (Howe et al., 2005; Lockie, 2002). Concerns also include the ecological viability of plantation operations, with members of the public voicing concerns surrounding negative effects on biodiversity, degraded water quality, chemical use, landscape fragmentation, and tourism issues (Schirmer & Kanowski 2001; Wilkinson et al. 2001). Community economics also come into play: rural communities with a robust economy are less likely to express concerns with

plantations than communities with an economy lacking a diverse array of employment opportunities (Tonts et al., 2001).

Previous research conducted in the study area indicates that cognitive and emotional aspects define the attitudes people possess toward plantations (Diaz et al., 2015). Results showed that perceived impacts and perceived ecosystem service provisions influence the shaping of values (Diaz et al., 2015). For example, the majority of respondents indicated positive perceptions regarding the impacts plantations have on local employment opportunities and climate change mitigation in Diaz's study. Forests are capable of providing ecosystem services desired by humans (MEA, 2005; Vihervaara, 2012), leading to the consideration of the perceptions of ecosystem service provision in eucalyptus plantations. The weighted Eucalyptus Value Index was used to test the predictor capability of perceived ecosystem service provision. Research conducted in Ubajay resulted in an appreciation for the income provided by the local forestry industry (Marini, 2016), adding forestry income as a variable to consider. Diaz et al. (2015) also found that environmental values come into play: Respondents who expressed greater levels of environmental concern had more negative views of tree plantations than individuals who expressed less prioritization for environmental values. Years spent living in the community was considered as dramatic land use change has occurred since the implementation of the Plantation Investment Law, Law N° 25080, an incentive law that encourages growth of the plantation forestry industry in Argentina (MAGyP, 2008; Silva et al., 2016). Research in the study area previously documented the negative perceptions held by long-term residents, who reported losing their local customs and traditions with the transition to a eucalyptus-dominated landscape (Marini, 2016). The gender and automobile ownership variables were added in a more exploratory nature that was less based on the literature, although Scholte et al. (2015) indicates that socio-cultural valuations and value orientations may be impacted by personal characteristics such as gender (Scholte et al., 2015). The impact of gender runs counter to the results of Diaz et al. (2015) where gender was found to not have an effect on the attitudes people hold toward tree plantations.

Purpose of Study

This study aims to assess how individual acceptability of plantation forestry is influenced by the valuation of ecosystem services, environmental beliefs, sense of place, and impacts to well-being

from plantations. The valuations of ecosystem services collected from survey data in Ubajay and La Criolla were utilized to determine what ecosystem services community members value most. As plantation is likely in the study area, this study also aims to discover what elements predict support for, or lack thereof, plantation expansion. The study answers the following research questions:

1. What ecosystem services do residents of Ubajay and La Criolla value most in their communities?

2. What are the strongest predictors for support of eucalyptus expansion?

Methods

Study Sites

Two communities within the Entre Ríos Province of Argentina, Ubajay and La Criolla, were selected as study sites to understand perceptions of eucalyptus plantations among individuals living in communities containing distinct land use compositions. The two communities differ substantially in their land cover, with Ubajay's landscape being dominated by large eucalyptus plantations and La Criolla experiencing a transition moving away from its traditional citrus-dominated landscape to now include small and medium-scale eucalyptus plantations and other crop types (Silva et al., 2016; Silva, 2016). Forty-five percent of the land in and around Ubajay, a community of 3,507 residents as of 2010, and thirty-eight percent of the land in around and around La Criolla, a community of 2,382 people as of 2010, is covered by tree plantations (Silva, 2016).

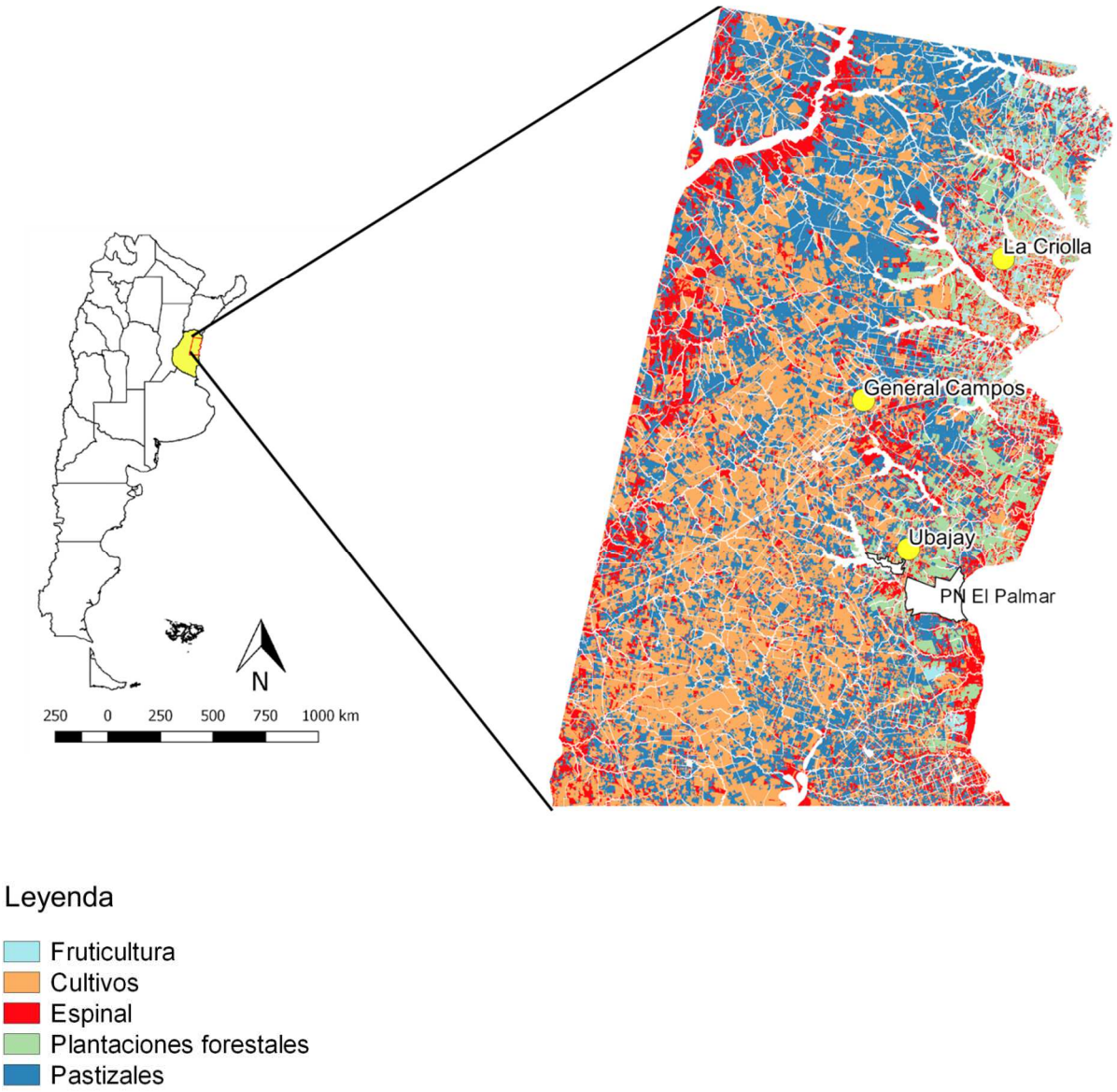

Figure 1. Study area and land coverage map, adapted from PIRE Argentina Interactive Community Fora presentations, 2017.

Survey data was collected in the study communities in 2014 and 2015. Households in the study communities were enumerated, and a randomly selected participant was chosen from each household. The survey focused on community members' perceptions of the impacts eucalyptus plantations have on the local natural environment and local socioeconomics; the survey also focused on participants' valuation of an array of ecosystem services from traditional agricultural and plantation land uses (Appendix 1). Quantitative data from survey respondents was analyzed via SPSS. The survey data was utilized in this paper to answer the following research questions:

1. What ecosystem services do residents of Ubajay and La Criolla value most in their communities?

2. What are the strongest predictors for support of eucalyptus expansion?

The survey asked respondents to indicate the level of importance they hold for nine ecosystem services (attractive scenery, recreation opportunities, clean air, clean water, food provision, economic opportunities, bird habitat, water quantity, and productive soils) to be present in their local community. Previous research indicates that respondents often report that all ecosystem services in question are important; however, it is uncommon for a particular landscape type to be able to provide all ecosystem services (Horne & Ovaskainen, 2001, cited by Horne et al., 2005; Scholte et al., 2015). To address the issue with participants' high valuations of the importance of the ecosystem services listed in the survey, a weighted index (Eucalyptus Value Index) was created. This index combined the responses to the importance of each ecosystem service, which was ranked on a five-point Likert-type scale where 1 = not important and 5 = very important, with responses to landscape capability of ecosystem service provision. Respondents were asked whether eucalyptus plantations provided each of the nine ecosystem services, with a "no" or "don't know" response equaling zero and a "yes" equaling 1. Thus, if the respondent indicated that eucalyptus was incapable of providing a particular ecosystem service, the zero "no" response would be multiplied by the valuation the respondent had given to the importance of the ecosystem service, making the total index response equal zero. If a respondent perceived that eucalyptus was capability of providing the ecosystem service, the valuation for the importance of that service would remain as reported by the participant for the index. To test the internal consistency of these responses and develop a summated scale, a reliability test was then conducted for the summed scores using Cronbach's Alpha.

A stepwise model was created to test the effects of particular variables as predictors of support for eucalyptus expansion. The stepwise regression model is built through adding and removing predictor variables in a stepwise entry method until there is no longer justification for the continued addition or removal of additional predictors. This method is built on the theoretical model of identifying what should predict support, and what predictors are most important in the model. Identification of plantation expansion support factors was important to this study because

plantations are expanding in the study area, and we wanted to predict what factors influenced social acceptability for plantation expansion. Participants were asked to indicate their support for expansion on a five-point Likert-type scale where 1 = in total disagreement and 5 = in total agreement. The variables considered, hypothesized in order from highest predicted impact as a predictor of support to lowest predicted impact as a predictor of support were:

- Perceived ecological and socioeconomic impacts – When perceived impacts were more positive, support for expansion will increase.
    - Impacts were measured on a five-point Likert-type scale where 1 = very negative and 5 = very positive.
- Perceived ecosystem service provision – When participants feel that eucalyptus provides more valued ecosystem services, support for expansion increases.
    - Ecosystem service provision was measured on via binary data where 0 = no or don't know and 1 = yes.
- Income from forestry – When more people receive income from plantation forestry, support for expansion increases.
    - Income was measured as binary data where 0 = no and yes = 1.
- Nature value index – When participants value nature over the economy, support for expansion decreases.
    - Nature value was measured on a seven-point Likert-type scale where 1 = totally disagree and 7 = totally agree
- Years spent living in the community – Longer time spent living in the community decreases support for expansion.
    - Respondents filled out this information with actual years spent living in their community.
- Gender – When more male participants are present, support for expansion increases.
    - Gender was measured as binary data where 0 = male and 1 = female
- Automobile ownership – As automobile ownership increases, support for expansion increases.
    - Automobile ownership was measured as binary data where 0 = no and 1 = yes

To test the impact of information provision and discussion on perceptions of plantation impacts and acceptability of plantations, the PIRE team traveled to Argentina in December 2017 to present results to study communities through Interactive Community Fora. PIRE research was conducted in and around Ubajay, a community with land use dominated by plantations, and La Criolla, a community with mixed land use (Phifer et al., 2016; Silva, 2016). Participants were given a pre-test to ascertain their judgments of plantations' effects on birds (Phifer et al., 2016), pollinators, soils, water quantity, and water quality, and the socioeconomic aspects of economic opportunities, changes to the local economy, stable employment, job opportunities for women, maintaining land ownership, and desire to stay in the community (Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Participants were also asked about their level of support for eucalyptus plantations and their expansion. Findings on all environmental aspects except water quality were presented by the PIRE research team, and subsequent facilitated discussion was held that focused on both the environmental and socioeconomic effects of plantation forestry. A post-test was then given to participants to determine any changes in judgments after information provision and discourse. Demographic information was also collected, including years lived in the community, age, gender, and forestry income. The Interactive Community Forum design was adapted from Becker et al., 2003. See Chapter 3 for a more in-depth description of the Interactive Community Forum (ICF) methodology.

Results

The 2014/2015 survey, which utilized random sampling to ensure a representative sample of each community, found that the average years spent living in these communities was approximately 23 in Ubajay (N = 90), and 29 in La Criolla (N = 94), compared to the average of 23 year in Ubajay (N = 24) and 31 years in La Criolla (N = 12) collected from ICF participants. The gender breakdown showed 43.2 percent of Ubajay respondents were male; respondents in La Criolla were 51.1 percent male. The survey showed 42.2 percent of Ubajay respondents received income from sawmills or plantations, while 11.7 percent of La Criolla respondents indicated the same. Local government data for Ubajay confirms the strong economic driver of forestry, as records indicate that seventy percent of the population receives direct income from forestry (Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009).

Community members were asked to indicate their level of importance they held for nine ecosystem services. Based on participant responses to ecosystem service importance, all ecosystem services were highly rated with all means recorded at 4.40 and higher on a five-point Likert-type scale (Table 1). An ecosystem services index was created from this data, and reliability analysis was conducted. The overall reliability for the index was a Cronbach's Alpha of 0.735, indicating acceptable reliability. The means ranged from an importance value of 4.40 (recreation opportunities) to 4.85 (clean air). On its own, however, this index did little to provide as to which ecosystem services were most valued in a landscape with eucalyptus plantation coverage as all means indicated a high level of importance for participants.

	N	M	(S.D.)	Cronbach's Alpha if Item Removed
Attractive scenery	180	4.45	0.699	0.701
Recreation	176	4.40	0.650	0.704
Clean air	179	4.85	0.379	0.721
Clean water	177	4.74	0.589	0.727
Food	174	4.58	0.705	0.677
Economic opportunities	178	4.70	0.624	0.716
Birds	176	4.52	0.683	0.704
Lots of water	175	4.70	0.550	0.720
Productive soils	178	4.77	0.437	0.723
Index	**168**	**41.71**		

Cronbach's Alpha for all 9 items: 0.735

Table 1. Ecosystem service importance index. Importance was measured on a five-point Likert-type scale where 1 = not important and 5 = very important.

Research question 1 tested the valuation of ecosystem service provision in the study communities with the creation of a eucalyptus value index. The eucalyptus value index provided a weighted score depicting both the importance placed upon each ecosystem service (as shown above in Table 1) alongside the community members' perception of eucalyptus as a land use to provide the respective ecosystem services (Table 2). A reliability analysis revealed a Cronbach's Alpha of 0.64. It is expected that the Cronbach's Alpha for the index was not higher due to the specificity of the ecosystem services included in the index as they relate to eucalyptus. The included variables likely move in different directions (ex. the relationship of food with eucalyptus vs. the relationship of economic opportunities with eucalyptus) compared to the overall values for the index.

	N	M	(S.D.)	Cronbach's Alpha if Item Removed
Attractive scenery	168	2.795	2.240	0.581
Recreation	171	2.051	2.280	0.588
Clean air	172	3.821	2.014	0.607
Clean water	169	1.724	2.313	0.618
Food	167	0.609	1.572	0.620
Economic opportunities	167	4.141	1.675	0.635
Birds	168	3.487	2.005	0.624
Lots of water	171	1.141	2.062	0.621
Productive soils	171	2.397	2.398	0.611
Index	**156**	**22.167**		

Cronbach's Alpha for all 9 items: 0.64

Table 2. Eucalyptus value index. Means were measured with a combination of a five-point Likert-type scale regarding the importance of ecosystem services where 1 = not important and 5 = very important. The importance means were multiplied by the capability of eucalyptus plantations to provide the respective ecosystem service, where 0 = no and 1 = yes.

Community members were asked to indicate their level of support for eucalyptus plantation expansion on a five-point Likert-type scale, and Ubajay showed stronger support (m = 3.77) than La Criolla (m = 2.86).

Research question 2 (What are the strongest predictors of support for eucalyptus expansion?) focused on determining the predictors of support for eucalyptus, was tested by conducting stepwise regression modeling to determine the best predictors of support for eucalyptus plantation expansion when considering eucalyptus plantation impacts, the perceived provision of ecosystem services in eucalyptus plantations, income from the forestry industry, the valuation of nature over economics, years spent living in a study community, gender, and automobile ownership. A stepwise entry method was used for the aforementioned variables, and the best predictive and statistically significant regression model was produced (Table 3). Results indicated that the Plantation Impacts Index, the Nature Value Index (prioritizing nature over the economy), the Eucalyptus Value Index (importance of ecosystem services and capability of eucalyptus to provide ecosystem services), and income from forestry were all significant predictors of support for eucalyptus expansion, with 47.3 percent of all variance being explained with these four independent variables (Table 3). Correlations between these four variables and support for expansion were telling as well. As perceptions of impacts were perceived more

positively, support for eucalyptus expansion increased (r = .641, p = .000, n = 143). As the valuation of ecosystem services and the perception of eucalyptus having the capability to provide ecosystem services increased, support for eucalyptus expansion increased (r = .401, p = .000, n = 168). As income from the forestry industry increased, support for expansion increased (r = .197, p = .004, n = 181). As the prioritization of nature over the economy increased, support for plantation expansion decreased (r = -.105, p = .080, n = 179). Years spent living in the community, gender, and automobile ownership were not significant predictors of support for eucalyptus expansion. The model shows the predictive power of the four variables, with the plantation impacts index being the strongest predictor for expansion support (Table 3). Strength of the predictors was measured using the standardized coefficients beta because all of the considered variables were not measured on the same scale; thus, the use of the standard coefficients beta puts variables on a scale without bias.

	Model 1		
Independent variable	Beta	Std. error	P value
Plantation impacts index	0.556	0.009	0.000
Eucalyptus value index	0.186	0.086	0.010
Forestry income	0.135	0.195	0.036
Nature value index	-0.151	0.025	0.019
Years lived in community	--	--	--
Gender	--	--	--
Car ownership	--	--	--
R squared = 0.473, F = 29.660, df = 132 N = 181			

Table 3. Regression results via stepwise entry with support for eucalyptus plantation expansion as the dependent variable.

Regression analysis was also conducted using the same seven variables in Table 3, with an additional variable, community. While resulting in a significant correlation (r = -.336, p = 0.000, n = 181), the community variable was not included in the model as the variable did not explain additional variance not already accounted for by the combination of the plantation impacts index, the eucalyptus value index, forestry income, and the nature value index. The rationale for

conducting this particular regression focused on our desire to identify predicting factors for support of eucalyptus expansion. This is key to interpreting the factors that influence social acceptability as plantation will likely to continue to expand throughout the study area.

ICF Results

The mean age of ICF participants in Ubajay and La Criolla was 44 and 38 years of age, respectively. Average years lived in Ubajay was 23 years, while the mean years spent living in La Criolla was higher with an average of 31 years. These averages for time spent living in the study communities are strikingly similar to the PIRE survey data collected in 2014 and 2015 in each study community. Both community fora were heavily male dominated, with 75 percent of Ubajay's participants being male and 81.8 percent of La Criolla's participants being male with survey results being nearly equal for gender in the survey. Participants were asked whether they or any of their immediate family members received income from the forestry industry. Receiving income from the forestry industry was commonplace in Ubajay, with 66.7 percent of forum participants indicating that they received earnings from forestry; forestry income was seen less frequently among La Criolla residents, with only 27.3 percent of participants indicating that they receive income from forestry. Local government data for Ubajay confirms the strong economic driver of forestry, as records indicate that seventy percent of the population receives direct income from forestry (Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009).

Because of the predictive power of the perceived impacts of eucalyptus on the local environment gleaned from the collected survey data, we also wanted to test how the provision of scientific information would affect acceptability judgments. This provided an avenue to test the stability of participant perceptions expressed in the survey. Previous research has shown that a gap exists between what individuals report a preference for regarding specific policy and what those same individuals report a preference for when provided with information on the topic and the opportunity to reflect (Fishkin, Luskin, & Jowell, 2000). Increased exposure to information via the PIRE team's findings on the environmental effects of eucalyptus resulted in an overall increased level of awareness of effects for both communities, with La Criolla being more receptive to acknowledging the severity of effects than participants in Ubajay. Data was not

presented on plantation effects to water quality, so no change was expected in this judgment post-workshop. To further determine the effect of information provision and discussion on participants' judgments of eucalyptus plantation impacts, nonparametric paired testing was conducted via a Wilcoxon signed-rank test (Tables 4 and 5). Results indicated that after exposure to information and discourse, Ubajay's median for post-workshop judgments of native pollinator effects (Mdn = 3) were significantly lower than pre-workshop judgments (Mdn = 4, Z = -2.050, p = 0.040, Table 4). La Criolla responses were significantly more negative in the post-workshop for effects to native birds (Mdn = 2) than in the pre-workshop (Mdn = 3, Z = -2.209, p = 0.027), with impacts to native pollinators and water quantity experiencing similar significant post-workshop decreases (Table 5). While not statistically significant, La Criolla judgments for impacts to soils were viewed more negatively in the post-workshop (Mdn = 2) to a degree that was statistically suggestive (pre-workshop Mdn = 2, Z = -1.814, p = 0.066, Table 5).

Community Judgments of Environmental Effects in Ubajay – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop				Ubajay post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Impacts on native bird species	6	2.83	4	(1.169)	6	2.67	3	(1.033)	-1.000	0.317
Impacts on native pollinator species	9	4.11	4	(1.269)	9	2.67	3	(1.581)	-2.050	**0.040**
Impacts on soils	9	3.44	3	(0.882)	9	3.11	3	(0.601)	-1.342	0.180
Impacts to water quantity	9	2.56	3	(0.726)	9	2.89	3	(0.601)	-1.732	0.083
Impacts to water quality	7	2.71	3	(0.756)	7	3.14	3	(0.378)	-1.342	0.180

Table 4. Ubajay matched pair means of judgments of environmental effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

Community Judgments of Environmental Effects in La Criolla – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop				La Criolla post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Impacts on native bird species	9	3.22	3	(0.972)	9	2.00	2	(0.500)	-2.209	**0.027**
Impacts on native pollinator species	11	3.82	4	(1.328)	11	2.00	2	(0.632)	-2.514	**0.012**
Impacts on soils	8	2.50	2	(1.069)	8	1.50	2	(0.535)	-1.814	0.066
Impacts to water quantity	9	3.22	4	(0.972)	9	2.22	2	(0.972)	-2.264	**0.024**
Impacts to water quality	5	2.80	3	(0.447)	5	2.60	2	(1.517)	-0.272	0.785

Table 5. La Criolla matched pair means of judgments of environmental effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

When considering plantation effects on socioeconomics, no significant effects were present in Ubajay. A Wilcoxon signed-ranks test indicated that La Criolla judgments of the effects on economic opportunity in the post-workshop were significantly more negative (Mdn = 2) than in the pre-workshop (Mdn = 4, Z = -1.947, p = 0.052, Table 7). La Criolla's judgment of the effects for desiring to stay in the community were significantly more negative in the post-workshop (Mdn = 3) than in the pre-workshop (Mdn = 5, Z = -2.070, p = 0.038, Table 7).

Ubajay Community Judgments of Socioeconomic Effects – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop				Ubajay post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Economic opportunities	9	4.56	5	(0.527)	9	4.78	5	(0.441)	-1.414	0.157
Stable employment	9	4.44	5	(1.014)	9	4.67	5	(0.500)	-0.816	0.414
Job opportunities for women	9	3.00	3	(0.707)	9	3.56	4	(0.726)	-1.890	0.059
Maintaining land ownership	9	3.11	3	(1.054)	9	3.33	3	(1.118)	-0.552	0.581

Desire to stay in the community	9	4.56	5	(0.527)	9	4.78	5	(0.441)	-1.414	0.157

Table 6. Ubajay matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

La Criolla Community Judgments of Socioeconomic Effects – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop				La Criolla post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Economic opportunities	11	3.27	4	(1.272)	11	2.55	2	(1.036)	-1.947	**0.052**
Stable employment	8	2.50	2	(1.414)	8	1.75	2	(0.707)	-1.857	0.063
Job opportunities for women	9	1.89	1	(1.269)	9	1.33	1	(0.500)	-1.518	0.129
Maintaining land ownership	8	2.50	2	(0.756)	8	2.13	2	(0.641)	-1.342	0.180
Desire to stay in the community	10	4.20	5	(1.033)	10	3.00	3	(1.247)	-2.070	**0.038**

Table 7. La Criolla matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

A Wilcoxon signed-rank test indicated that La Criolla's acceptability for expansion decreased significantly in the post-workshop (Mdn = 2) when compared to recorded acceptability in the pre-workshop (Mdn = 4, Z = -2.271, p = 0.023, Table 9). No other significant differences were detected in either community for judgments of plantation acceptability.

Ubajay Community Levels of Acceptability for Plantations – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop			Ubajay post-workshop				
	N	M	S.D.	N	M	S.D.	Z	Sig.
Current production	10	4.50	(0.707)	10	4.60	(0.699)	-1.000	0.317

Plantation expansion	9	4.33 (0.707)	9	4.44 (0.726)	-0.577	0.564

Table 8. Ubajay matched pair means of acceptability levels for current plantation production and plantation expansion and Wilcoxon signed-rank test results of acceptability levels. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

La Criolla Community Levels of Acceptability for Plantations – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop			La Criolla post-workshop				
	N	M	Mdn. (S.D.)	N	M	Mdn. (S.D.)	Z	Sig.
Current production	9	3.22	(1.202)	9	2.67	(1.500)	-1.179	0.238
Plantation expansion	6	3.50 (0.837)		6	2.17 (0.753)		-2.271	**0.023**

Table 9. La Criolla matched pair means of acceptability levels for current plantation production and plantation expansion and Wilcoxon signed-rank test results of acceptability levels. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

Discussion

Research Question 1: What ecosystem services do residents of Ubajay and La Criolla consider most important for their communities to provide?

The five-point Likert-type means for all nine ecosystem services (attractive scenery, recreation opportunities, clean air, clean water, provision of food, economic opportunity generation, bird habitat, water quality, and maintenance of productive soils) indicated that all services were highly valued (means ranging from 4.40 to 4.85 where 1 = not important and 5 = very important). Alone, these means do not provide telling information about the different valuations of the aforementioned ecosystem services. Thus, combining the participants' Likert-type means for the ecosystem services with the participants' perceptions of eucalyptus's ability to provide highly valued ecosystem services gives a more accurate scale depicting both importance of the ecosystem services and the feasibility of having them provided in a eucalyptus plantation landscape. Using this eucalyptus value index, clear differences emerged among the ecosystem services that were not identifiable when considering only the importance rating. While all ecosystem services were highly valued on their own, the creation of the eucalyptus value index

provided a way to delve deeper into perceptions held by participants that showed where they felt that particular ecosystem services were supported in eucalyptus plantations (Table 2). Participants were capable of acknowledging that some valued ecosystem services were not supported in the contemporary plantation landscape, such as the provision of food. Other highly valued ecosystem services, such as clean air, resulted in participants perceiving that eucalyptus plantations were capable of providing the service. Some ecosystem services and the capability of provision from eucalyptus were less understood by study participants. Bird habitat, for example, is in fact degraded in eucalyptus plantations when compared with other local land use types such as native espinal, livestock pastures, croplands, and mixed use (Phifer et al., 2016), but participants indicated their perception that eucalyptus could provide this ecosystem service. This finding was addressed during the ICF sessions held in the study communities in December 2017 (see Chapter 3 for a full description of PIRE team research findings presented during the ICFs). This speaks to the importance of providing community members with the best available science and actively engaging these individuals in a deliberative process (Becker et al., 2002; Fishkin, Luskin, & Jowell, 2000). Through the provision of scientific information, communities are provided with data on actual impacts that affect local environments. This process supplies communities with findings that can inform decision making when considering the local plantation forestry industry and effects on available ecosystem services caused by eucalyptus plantations. A more informed populace may change perceptions regarding the acceptability of economic and environmental tradeoffs when more awareness of plantation effects is present.

Research Question 2: What are the strongest predictors for support of eucalyptus expansion?

As indicated in the stepwise regression model, perceived impacts from eucalyptus (plantation impacts index) was the strongest predictor of support for eucalyptus, with 41.1 percent of the variance in the model explained by this variable alone. This finding supports previous research that found the perceived impacts from plantations were important predictors of plantation support (Diaz et al., 2015; Silva, 2016). The eucalyptus value index, a combination of the importance delegated to each ecosystem service in the survey alongside participants' perception of plantations' capability for provision of valued ecosystem services, was also a key predictor. Income from the forestry industry proved to be a significant predictor for plantation expansion support. This finding supports previous research that found that economic benefits are highly

valued as ecosystem services and influence support for ecosystems that provide this service (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014) and the acknowledged appreciation from locals in the study area regarding employment opportunities and a created place identity around the forestry industry (Marini, 2016). Individuals' values contribution to their support of eucalyptus plantations is consistent with Diaz et al. (2015), which concluded that higher levels of environmental concerns led to less support for tree plantations. As seen in our model, a prioritization for nature over economic gain resulted in decreased support for eucalyptus expansion. Community was not a significant predictor despite the pronounced differences in the two communities' land coverage composition, employment, and views toward the plantation industry (Silva, 2016). It is likely that the variance provided by the community variable is already predicted by other variables that have a greater effect on the model, diminishing the effect community has on the model as a whole, despite being negatively correlated with support for expansion. Demographics (years lived in the community, gender, and automobile ownership) were not significant predictors, as previously assessed by Diaz et al. when considering gender (2015). Years lived in the community was originally expected to hold significance due to the expressed concern from long-term residents for the changing local landscape and local identity, leading to a perceived loss in historical customs and traditions (Marini, 2016). Gender was expected to have an effect as employment in the plantation forestry industry is heavily male-dominated. Automobile ownership, an exploratory variable, was expected to have an effect as a variable indicating a certain level of economic achievement, something that the forestry industry has contributed to in the study communities.

Interactive Community Fora Results

Results from the two ICFs indicated that the provision of information caused a change in judgments of effects caused by eucalyptus plantations. The acknowledgment of the severity of negative effects was more pronounced in La Criolla than in Ubajay, a forestry-dependent community. In addition to the documented differences in how participants in the two communities reacted to information from the PIRE team research findings, support for plantations and for plantation production remained strong in Ubajay. In contrast, La Criolla's support for current production and for expansion declined, with a sharp decrease in support for expansion documented in the post-workshop session of the ICF. As Ubajay is a community that

relies heavily on the forestry industry for income, while La Criolla exists in a transitioning economy not dominated by plantation forestry, the ICF results follow that forestry income is a predictor of support for eucalyptus, as was also seen based on regression models of survey data from both communities. This is indicative of the importance placed on the monetary value of ecosystem services (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014) and aids in explaining that those who receive economic benefits from plantations, mostly Ubajay residents, are more likely to continue to support plantation expansion despite the occurrence of negative environmental effects (Phifer et al., 2016; unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Changes in sense of place were also acknowledge during the discussion sessions in the ICFs in each community. In Ubajay, changes to sense of place were apparent among long-time residents who observed new residents in the community who practice customs and traditions that were not historically present in the community (Observation, December 12, 2017). The effects on sense of place had been documented previously in Ubajay (Marini, 2016). In La Criolla, the changes to sense of place focused on discussions of land use change and a changing economy toward which long-time residents showed reluctance (Observation, December 13, 2017). This observed relationship between land use change and its effects on sense of place has been documented in previous research (Davenport & Anderson, 2005; Marini, 2016; Schirmer et al., 2008).

Conclusion

Simply looking at the valuation of the importance placed upon ecosystem services may not reveal perceptions held by community members living in areas that have experienced or are experiencing significant land use change. More can be discerned regarding community perceptions by considering the perceived capability of a land use to provide ecosystem services desired by community members. This more robust eucalyptus value index is capable of revealing more about what community members perceive as valuable provision of ecosystem services (Diaz et al., 2015; MEA, 2005; Vihervaara, 2012). Perceived impacts from eucalyptus was a strong predictor of eucalyptus support, as expected based on research conducted previously in the study area (Diaz et al., 2015; Silva, 2016). Forestry income, which provides clear economic benefits in Ubajay that is currently lacking in La Criolla, is another predictor of support for plantation expansion, with support for expansion increasing with increased income from forestry

(Diaz et al., 2015; Marini, 2016). According to responses in the regression analysis, individuals possessing more ecocentric views on the nature value index held less support for eucalyptus expansion than did individuals who focused more on the economic benefits of eucalyptus, leading to another significant predictor for support as predicted based on previous research (Diaz et al., 2015).

While Ubajay and La Criolla both experienced a degree of changed judgments after learning about the effects of eucalyptus plantations on water, soil, and biodiversity, the change seen in these two communities was not equal. Ubajay was more resistant to judgments indicating the severity of negative environmental impacts stemming from plantations, while La Criolla was more accepting of the results presented during their ICF. Effects on sense of place were acknowledged in both communities, with lifelong residents acknowledging changes to local traditions and practices due to a more diverse influx of new residents relocating to the study communities for employment in the plantation industry, particularly in Ubajay, and changes to land use composition and the local economy in La Criolla (Observations, December 12-13, 2017).

A limitation of this study was the small sample sizes for both communities in the ICFs, which is a common issue with participatory research. Larger sample sizes could have allowed for a more robust statistical analysis, and a higher turnout in communities could have possibly provided the opportunity to be able to generalize the results onto the communities with more diverse participation. Participant population samples in each community were skewed, with participant populations that were heavily male-dominated, and Ubajay with a participant population that was dominated by individuals employed in the forestry industry. The participant populations were not representative of the community populations as can be seen when reviewing the 2014/2015 randomized sample survey data, resulting in some sects of the communities being underrepresented.

The results of this study focus on survey data and data collected during the ICF workshops in Ubajay and La Criolla. The results of this study are not generalizable to a larger public; they speak to rural communities in the Argentina Pampas that are either dominated by the plantation forestry industry or are transitioning to an economy that includes employment in tree plantations.

Our results help to inform discussions about plantation expansion and the role of perceptions of impacts on acceptability and the value of information provision.

As land coverage dominated by plantations is expected to increase due to incentivized practices and policy that encourage the growth of the Argentine plantation forestry industry (MAGyP, 2008; Silva, 2016), the consideration of perceptions of individuals living in these changing landscapes is critical. Future planning of plantations should carefully consider the ecosystem services desired by community members and their perception of plantations' ability to provide their needs. Also of importance is the use of public outreach regarding the tradeoffs likely to occur for particular ecosystem services as more expansion takes place. Outreach about these tradeoffs allows for more informed judgments. Decision makers should take into account avenues for mitigation of negative effects on desired ecosystem services for communities experiencing land use change that affects ecosystem services provided by the local environment.

References

Anderson, N. M., Williams, K. J. H., & Ford, R. M. (2013). Community perceptions of plantation forestry: The association between place meanings and social representations of a contentious rural land use. *Journal of Environmental Psychology*, 34, 121-136. doi:10.1016/j.jenvp.2013.02.001

Aretano, R., Petrosillo, I., Zaccarelli, N., Semeraro, T., & Zurlini, G. (2013). People perception of landscape change effects in small Mediterranean islands: A combination of subjective and objective assessments. *Landscape and Urban Planning, 112*, 63-73.

Becker, D. R., Nielsen, E. A., Harris, C. C., & McLaughlin, W. J. (2002). *Examining the effectiveness of small group dialogue in projecting the effects of EIS alternatives.* (Order No. 3050221). Available from ProQuest Dissertations & Theses Global. (305599888)

Becker, D. R., Harris, C. C., McLaughlin, W. J., & Nielsen, E. A. (2003). A participatory approach to social impact assessment: The interactive community forum. *Environmental Impact Assessment Review, 23*(3), 367-382. doi:10.1016/S0195-9255(02)00098-7

Bremer, L., & Farley, K. (2010). Does plantation forestry restore biodiversity or create green deserts? A synthesis of the effects of land-use transitions on plant species richness. Biodiversity and Conservation, 19(14), 3893-3915. doi:10.1007/s10531-010-9936-4

Brockerhoff, E. G., Jactel, H., Parrotta, J. A., & Ferraz, S. F. B. (2013). Role of eucalypt and other planted forests in biodiversity conservation and the provision of biodiversity-related ecosystem services. *Forest Ecology and Management*, 301, 43-50. doi:10.1016/j.foreco.2012.09.018

Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied Geography, 27*(2), 89-111. 10.1016/j.apgeog.2006.11.002

Calviño-Cancela, M., Rubido-Bará, M., & van Etten, E. J. B. (2012). Do eucalypt plantations provide habitat for native forest biodiversity? *Forest Ecology and Management*, 270, 153-162. doi:10.1016/j.foreco.2012.01.019

Carvalho-Ribeiro, S. M., Lovett, A., & O'Riordan, T. (2010). Multifunctional forest management in northern Portugal: Moving from scenarios to governance for sustainable development. *Land use Policy, 27*(4), 1111-1122.

Chen, L., He, Z., Zhu, X., Du, J., Yang, J., & Li, J. (2016). Impacts of afforestation on plant diversity, soil properties, and soil organic carbon storage in a semi-arid grassland of northwestern China. *Catena*, 147, 300-307. doi:10.1016/j.catena.2016.07.009

Cheng, A. S., Kruger, L. E., & Daniels, S. E. (2003). "Place" as an integrating concept in natural resource politics: Propositions for a social science research agenda. *Society & Natural Resources, 16*(2), 87-104. 10.1080/08941920309199

Conrad, E., Christie, M., & Fazey, I. (2011). Understanding public perceptions of landscape: A case study from Gozo, Malta. *31*, 159–170. doi: 10.1016/j.apgeog.2010.03.009

Cubbage, F., Koesbandana, S., Mac Donagh, P., Rubilar, R., Balmelli, G., Olmos, V. M., de la Torre, R., Murara, M., Hoeflich, V. A., Kotze, H., Gonzalez, R., Carrero, O., Frey, G., Adams, T., Turner, J., Lord, R., Huang, J., MacIntyre, C., McGinley, K., Abt, R., & Phillips, R. (2010). Global timber investments, wood costs, regulation, and risk. *Biomass and Bioenergy*, 34(12), 1667-1678. doi:10.1016/j.biombioe.2010.05.008

Cubbage, F., Mac Donagh, P., Sawinski Júnior, J., Rubilar, R., Donoso, P., Ferreira, A., Hoeflich, V., Olmos, V. M., Ferreira, G., Balmelli, G., Siry, J., Báez, M. N., & Alvarez, J. (2007). Timber investment returns for selected plantations and native forests in South America and the southern United States. *New Forests*, 33(3), 237-255. doi:10.1007/s11056-006-9025-4

Davenport, M. A., & Anderson, D. H. (2005). Getting from sense of place to place-based management: An interpretive investigation of place meanings and perceptions of landscape change. *Society & Natural Resources, 18*(7), 625-641. 10.1080/08941920590959613

Daw, T., Brown, K., Rosendo, S., & Pomeroy, R. (2011). Applying the ecosystem services concept to poverty alleviation: The need to disaggregate human well-being. *Environmental Conservation, 38*, 370-379.

de Groot, R., Fisher, B., Christie, M., Aronson, J., Braat, L., Growdy, J., & Shmelev, S. (2010). Integrating the ecological and economic dimensions in biodiversity and ecosystem service

valuation. *The economics of ecosystems and biodiversity: Ecological and economic foundations* (). London: Earthscan.

de Groot, R. S., Wilson, M. A., & Boumans, R. M. J. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics, 41*(3), 393-408. 10.1016/S0921-8009(02)00089-7

Diaz, D., Gervasi, L., Roman, L., Vergara, L., Vergara, A. (2015). La preocupación ambiental y la actitud hacia las plantaciones forestales en comunidades de la región noreste de Entre Ríos. *XXIX Jornadas For. Entre Ríos*.

Elias, P., & Boucher, D. (2014). Planting for the future: How demand for wood products could be friendly to tropical forests. Union of Concerned Scientists.

FAO. (2006). Global forest resources assessment 2005: Progress towards sustainable forest management. Rome: Food and Agriculture Organization of the United Nations.

Farnum, J., Hall, T. E., & Kruger, L. E. (2005). *Sense of place in natural resource recreation and tourism: An evaluation and assessment of research findings.* Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station.

Fishkin, J. S., Jowell, R., & Luskin, R. L. (2000). Deliberative polling and public consultation. *Parliamentary Affairs*, 53(4) Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;query=Id:%22library/jrnart/8CT26%22

Fonseca, C., Guadagnin, D., Emer, C., Masciadri, S., Germain, P., & Zalba, S. (2013). Invasive alien plants in the Pampas grasslands: A tri-national cooperation challenge. *Biological Invasions*, 15(8), 1751-1763. doi:10.1007/s10530-013-0406-2

Ford, R. M. & Williams, K. J. H. (2016). How can social acceptability research in Australian forests inform social licence to operate? *Forestry*, 89(5), 512-524. doi:10.1093/forestry/cpv051

Forristal, L. J., Lehto, X. Y., & Lee, G. (2014). The contribution of native species to sense of place. *Current Issues in Tourism, 17*(5), 414-433. 10.1080/13683500.2012.723679

Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009. Propuestas de mejora de las actividades productivas del municipio de Ubajay (Pcia. de Entre Ríos) y bases para la creación y organización de un parque industrial sectoral utilizando herramientas de producción más limpia y simbiosis industrial.

Greider, T., & Garkovich, L. (1994). Landscapes: The social construction of nature and the environment. *Rural Sociology, 59*(1), 1-24. 10.1111/j.1549-0831.1994.tb00519.x

Horne, P., Boxall, P. C., & Adamowicz, W. L. (2005). Multiple-use management of forest

recreation sites: A spatially explicit choice experiment. *Forest Ecology and Management, 207*, 189-199.

Howe, G. T., Shindler, B., Cashore, B., & Hansen, E. (2005). Public influences on plantation forestry. *Journal of Forestry*, 103(2), 90-94.

Hunt, L., Bonetto, C., Marrochi, N., Scalise, A., Fanelli, S., Liess, M., Lydy, M. J., Chiu, M. C., & Resh, V. H. (2017). Species at risk (SPEAR) index indicates effects of insecticides on stream invertebrate communities in soy production regions of the Argentine Pampas. *The Science of the Total Environment,580*, 699-709. 10.1016/j.scitotenv.2016.12.016

INTA. (1995). Introducción, in: Manual para productores de eucaliptos de la Mesopotamia Argentina.

Jobbágy, E. G., & Jackson, R. B. (2004). Groundwater use and salinization with grassland afforestation. *Global Change Biology*, 10(8), 1299-1312. doi:10.1111/j.1365-2486.2004.00806.x

Larson, S., De Freitas, D. M., & Hicks, C. C. (2013). Sense of place as a determinant of people's attitudes towards the environment: Implications for natural resources management and planning in the great barrier reef, australia. *Journal of Environmental Management, 117*, 226-234. 10.1016/j.jenvman.2012.11.035

Lee, D. R. (2007). Assessing environment-development tradeoffs: A developing country perspective. The SAGE handbook of Environment and Society (pp. 181-190). London: SAGE Publications Ltd. doi:10.4135/9781848607873.n12

Lee, D. R., Barrett, C. B., Hazell, P., & Southgate, D. (2001). Assessing tradeoffs and synergies among agricultural intensification, economic development and environmental goals: Conclusions and implications for policy. Tradeoffs or synergies? Agricultural intensification, economic development and the environment. Wallingford, UK: CABI Publishing. doi:10.1079/9780851994352.0451

Lockie, S. (2002). Building social capital and community well-being through plantation forestry. *Proc. of Prospects for Australian Forest Plantations 2002 Conference.* 17-27. Taylor & Francis Group, LLC.

MAGyP. (2008). Ley 25.080 generalidades.

Marini, V. (2016). The relationship between sense of place theory and perceptions of environmental, social and economic impacts of the expansion of monoculture plantations: A case study of Ubajay, Entre Ríos Province, Argentina.

MEA. (2005). Ecosystems and well-being: Biodiversity synthesis. Millennium Ecosystem Assessment. Washington, DC.

Medan, D., Torretta, J., Hodara, K., de la Fuente, E., & Montaldo, N. (2011). Effects of agriculture expansion and intensification on the vertebrate and invertebrate diversity in the Pampas of Argentina. *Biodiversity and Conservation*, 20(13), 3077-3100. doi:10.1007/s10531-011-0118-9

NGP. (2015). Argentina, plantations in grasslands. New Generation Plantations.

Nosetto, M. D., Jobbágy, E. G., & Paruelo, J. M. (2005). Land-use change and water losses: The case of grassland afforestation across a soil textural gradient in central Argentina. *Global Change Biology*, 11(7), 1101-1117. doi:10.1111/j.1365-2486.2005.00975.x

Oteros-Rozas, E., Martin-Lopez, B., Gonzalez, J. A., Plieninger, T., Lopez, C. A., & Montes, C. (2013). Socio-cultural valuation of ecosystem services in a transhumance social-ecological network. *Regulatory Environmental Change.*

Payn, T., Carnus, J., Freer-Smith, P., Kimberley, M., Kollert, W., Shirong, L., Orazio, C., Rodriguez, L., Silva, L. N., & Wingfield, M. J. (2015). Changes in planted forests and future global implications. *Forest Ecology and Management*, 352, 57-67. doi: 10.1016/j.foreco.2015.06.021

Payton, M. A., Fulton, D. C., & Anderson, D. H. (2005). Influence of place attachment and trust on civic action: A study at sherburne national wildlife refuge. *Society & Natural Resources, 18*(6), 511-528. 10.1080/08941920590947940

Petrosillo, I., Zaccarelli, N., & Zurlini, G. (2010). Multi-scale vulnerability of natural capital in a panarchy of social–ecological landscapes. Ecological Complexity, 7(3), 359-367. doi:10.1016/j.ecocom.2010.01.001

Phifer, C. C., Knowlton, J. L., Webster, C. R., Flaspholer, D. J., & Licata, J. A. (2016). Bird community responses to afforested eucalyptus plantations in the Argentina Pampas. *Biodiversity Conservation*, 25, 1-29.

Raymond, C., Bieling, C., Fagerholm, N., Martin-Lopez, B., & Plieninger, T. (2016). The farmer as a landscape steward: Comparing local understandings of landscape stewardship, landscape values, and land management actions. *Ambio, 45*(2), 173-184. 10.1007/s13280-015-0694-0

Raymond, C. M., Bryan, B. A., MacDonald, D. H., Cast, A., Strathearn, S., Grandgirard, A., & Kalivas, T. (2009). Mapping community values for natural capital and ecosystem services. *Ecological Economics*, 68(5), 1301-1315. doi:10.1016/j.ecolecon.2008.12.006

Roca, E., & Villares, M. (2012). Public perceptions of managed realignment strategies: The case study of the Ebro Delta in the Mediterranean basin. *Ocean & Coastal Management, 60*, 38-47.

Sánchez Acosta, M. (1999). Tecnología de la madera de eucalipto en el mercosur y otros países.

XIV Jornadas for. Entre Ríos, 1-32.

Sánchez Acosta, M., & Sepliarsky, F. (2005). Tecnología de la madera de eucaliptos colorados: Propiedades – usos – posibilidades. *I Jornadas for. Santiago Del Estero*.

Schirmer, J. (2002). *Plantation forestry disputes: Case studies on concerns, causes, processes, and paths toward resolution. Technical report no. 42.* Hobart, Tasmania.

Schirmer, J. (2007). Plantations and social conflict: Exploring the differences between small-scale and large-scale plantation forestry. *Small-Scale Forestry*, 6(1), 19-33. doi:10.1007/s11842-007-9001-7

Schirmer, J., & Kanowski, P. (2001). Avoiding snatching defeat from the jaws of victory: Plantation forestry expansion in Australia. *Proc. of Commonwealth Forestry Conference.*

Schirmer, J., Williams, K., Borschmann, P., & Dunn, C. (2008). *Living with land use change: Different views and perspectives.*

Scholte, S. K. S., van Teefelen, A J A, & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics, 114*, 67-78.

Scholte, S. K. S., Todorova, M., van Teefelen, A J A, & Verburg, P. H. (2016). Public support for wetland restoration: What is the link with ecosystem service values? *Wetlands, 36*, 467-481. doi:10.1007/s13157-016-0755-6

Setten, G., Stenseke, M., & Moen, J. (2012). Ecosystem services and landscape management: Three challenges and one plea. *International Journal of Biodiversity Science, Ecosystem Services & Management, 8*(4), 305-312. 10.1080/21513732.2012.722127

Silva, C. (2016). Community perceptions of ecosystem services and human well-being from tree plantations in Argentina.

Silva, C. A., Nielsen, E. A., Abrams, J., Selfa, T., & Diaz, D. (2016). Community perceptions of tree plantation effects on ecosystem services and well-being in Argentina.

Smaldone, D., Harris, C., & Sanyal, N. (2008). The role of time in developing place meanings. *Journal of Leisure Research, 40*(4), 479. Retrieved from http://search.proquest.com/docview/201199195

Stedman, R. C. (2003). Is it really just a social construction?: The contribution of the physical environment to sense of place. *Society & Natural Resources, 16*(8), 671-685. 10.1080/08941920309189

Tengberg, A., Fredholm, S., Eliasson, I., Knez, I., Saltzman, K., & Wetterberg, O. (2012). Cultural ecosystem services provided by landscapes: Assessment of heritage values and

identity. *Ecosystem Services, 2*, 14-26.

Tonts, M., Campbell, C., & Black, A. (2001). Socio-economic implications of farm forestry. Kingston, Australia.

Tuan, Y. (1980). Rootedness versus sense of place. *Landscape, 24*(1), 3. Retrieved from http://search.proquest.com/docview/1311900459

Vihervaara, P., Marjokorpi, A., Kumpula, T., Walls, M., & Kamppinen, M. (2012). Ecosystem services of fast-growing tree plantations: A case study on integrating social valuations with land-use changes in Uruguay. *Forest Policy and Economics,* 14(1), 58-68. doi:10.1016/j.forpol.2011.08.008

Vosti, S. A. & Reardon, T. (1997). Sustainability, growth and poverty alleviation: A policy and agroecological perspective. Baltimore, MD.

Warman, R. (2014). Global wood production from natural forests has peaked. *Biodiversity and Conservation*, 23(5), 1063-1078. doi:10.1007/s10531-014-0633-6

Wilkinson, R., Roche, M., Krausse, M., & Smith, W. (2001). Food or forest? Contested land use in Wairoa district, New Zealand. *Consuming foods, sustaining environments* (pp. 110-124). Brisbane, Australia: Australian Academic Press.

Williams, K. J. H. (2014). Public acceptance of plantation forestry: Implications for policy and practice in Australian rural landscape. *Land Use Policy*, 38, 346-354. doi:10.1016/j.landusepol.2013.11.023

Williams, K. (2011). Relative acceptance of traditional and non-traditional rural land uses: Views of residents in two regions, southern Australia. Landscape and Urban Planning, 103(1), 55-63. 10.1016/j.landurbplan.2011.05.012

Williams, D. R., Patterson, M. E., & Roggenbuck, J. W. (1992). Beyond the commodity metaphor: Examining emotional and symbolic attachment to place. *Leisure Science*, 29-46. 10.1080/08941920701537015

Zagarola, J., Anderson, C., & Veteto, J. (2014). Perceiving Patagonia: An assessment of social values and perspectives regarding watershed ecosystem services and management in southern South America. *Environmental Management*, 53(4), 769-782. doi:10.1007/s00267-014-0237-7

Chapter 3. Interpreting Community Judgments of Eucalyptus Plantation Impacts through Interactive Community Fora

Abstract

Eucalyptus plantations have become a significant presence in the landscape of Argentine Pampas communities over the last two decades. A variety of effects stem from these plantation operations, including biodiversity, soils, ecohydrology, and socioeconomic impacts. This study focused on two Pampas communities: Ubajay, a community with significant historical eucalyptus plantation land coverage and forestry employment, and La Criolla, a community with an economy traditionally focused on citriculture that is currently experiencing a shift to include a greater focus on plantation forestry. An Interactive Community Forum was held in each community that provided participants with results from an interdisciplinary research study focused on eucalyptus plantation forestry that the two communities participated in over the last five years. The purpose of this study was to determine the effects information provisions and discourse on judgments of environmental and socio-economic impacts caused by eucalyptus and how those affected acceptability judgements of eucalyptus as a land use. Judgments in both communities changed after research findings were presented and subsequent discussion was held, with individuals in both communities judging environmental effects more negatively after the presentation of findings and discussion. La Criolla participants were more receptive to acknowledging the severity of negative environmental impacts from plantations than their Ubajay counterparts. Ubajay participants, while conceding the negative environmental effects of eucalyptus, continued to acknowledge the socioeconomic benefits of the plantation industry, and Ubajay participants were strongly supportive of current plantation production and further plantation expansion. La Criolla participants were less accepting of eucalyptus as a land use than those in Ubajay when considering current production and expansion potential as well as socioeconomic effects. The discovery of these differing community judgments lends to the importance of engaging the public with deliberative practices and exposure to the best available scientific information.

Keywords: eucalyptus, Interactive Community Forum, ecosystem services, acceptability, plantations, economics, information, judgments, democracy

Introduction

Tree plantation expansion in South America is viewed as a highly profitable activity (Cubbage et al., 2010; Cubbage et al., 2007); the economic benefits of expanding this industry stem from rapid tree growth, minimal costs for land and labor, and policies that incentivize plantation expansion practices (Paruelo, 2012), such as the Plantation Investment Law (MAGyP, 2008). Tradeoffs in the ecosystem services, the services the environment can provide to humans that possess ecological, economic, or socio-cultural value, occur from decisions that affect land use (MEA, 2005; Scholte et al., 2015). Environmental concerns for this study focused on detrimental effects plantations can have on biodiversity (Bremer and Farley, 2010; Jobbágy and Jackson, 2004; Phifer et al., 2016; unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017), water resources (Nosetto et al., 2005; Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017), and soils (Chen et al., 2016; unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Social impacts should be considered as well: Previous research has shown that afforestation of grasslands via tree plantation expansion did not lead to a changed standard of living in communities experiencing expansion, while a decrease was documented for employment conditions in areas experiencing plantation expansion (Carámbula & Piñeiro, 2006). In contrast, research conducted in Ubajay concluded that residents appreciated employment in the local forestry industry and associated a local sense of identity with this dominant industry (Marini, 2016). Public acceptability toward plantations is affected by environmental concerns (Schirmer & Kanowski 2001; Wilkinson et al. 2001), the type of land use that plantations are replacing (Howe et al., 2005; Lockie, 2002), and local economic structure (Tonts et al., 2001).

Argentine Forestry Industry, Policy, and Impacts

Forests provide an array of ecosystem services, the benefits that people obtain from ecosystems, such as provisioning services, including food and fiber, regulating services, such as climate regulation, flood control, and erosion control, supporting services, such as nutrient cycling and crop pollination, and cultural services, such as recreational opportunities (MEA, 2005; Vihervaara, 2012). As global demand for forest products increases rapidly (Payn et al., 2015), Argentina has responded by increasing its number of tree plantations and enacting national policies that bolster the domestic forestry industry. These tree plantations are cultivated through planting and/or seeding native or introduced tree species through afforestation or reforestation

(FAO, 2006). Land use change in Argentina, especially in the northeastern portion of the country, has been particularly significant due to the implementation of the Plantation Investment Law, Law N° 25080 (Silva et al., 2016). Enacted in 1999, the law encourages expansion of the country's domestic wood supply and decreases reliance on imported wood and paper products through subsidies and incentives that are advantageous to both new and existing tree plantation enterprises (MAGyP, 2008).

With a substantial increase in the demand for forestry products and federal policy that encourages an expanded forestry industry, it is inevitable that plantations will expand; grassland environments are expected to be heavily utilized for plantation expansion (NGP, 2015). This matches a global trend that shows the decline in procuring timber from natural forests (Warman, 2014) coupled with increased extraction from planted forests (Elias & Boucher, 2014; Warman, 2014).

Argentina is not unfamiliar with land use change; natural landscapes have been significantly altered for different uses since the area endured European colonization (Phifer et al., 2016). Before European colonization of the Argentine Pampas, the central plains region of Argentina known for its mild climate and fertile soils, the area was dominated by semi-nomadic ethnic groups who operated as hunter-gatherers (Fonseca et al., 2013; Hunt et al., 2017). With colonization came the introduction of cattle ranching, and the prominence of the cattle industry increased the importance placed on the natural resources of the grasslands, alongside creating a cultural identity for the Pampas region that persists into the present (Fonseca et al., 2013). The Pampas region has lost 90 percent of its natural landscape due to these land use changes (Medan et al., 2011).

As is seen in many countries across the globe, plantation forestry is often reliant on a small number of rapidly growing tree species (Calviño-Cancela et al., 2012), which is the case in Argentina with its strong presence of eucalyptus plantations in the Entre Ríos province and pine plantations in the province of Missiones. Eucalyptus was introduced into Argentina well before the creation of the country's contemporary plantation laws. The original introduction of a eucalyptus species into the country occurred in 1857 when *E. globulus* was brought in to provide windbreaks as well as to provide a form of decorative vegetation (INTA, 1995; Sánchez Acosta and Sepliarsky, 2005; Sánchez Acosta, 1999). The industrialization of eucalyptus took several

decades to occur after the original eucalypt introduction, with the beginnings of those types of plantations taking place in the Entre Ríos and Misiones Provinces in the 1940s (INTA, 1995). By the early 1990s, the Entre Ríos Department of Concordia had experienced a rapid uptick in land coverage of *E. grandis*, another species of eucalyptus commonly utilized in plantations (INTA, 1995). The Pampas and other locales within northeastern Argentina see rapid tree growth rates that provide quick returns on plantation investments, as is seen in the growth rate of 35 m^3/ha/year for *E. grandis* in the area (Cubbage et al., 2010; Cubbage et al., 2007). While eucalyptus grows quickly in the region, the planting of native tree species usually provides more suitable habitat for endemic species (Brockerhoff et al., 2013).

The documented negative environmental effects caused by eucalyptus plantations are numerous, including soil degradation, water resource overuse, and biodiversity loss (Bremer and Farley, 2010; Jobbágy and Jackson, 2004; Phifer et al., 2016). Afforestation in grasslands can modify soils, which can affect plant diversity and overall ecosystem function (Chen et al., 2016). Eucalyptus requires substantially more water than the native grasses and espinal, savanna ecosystems with clumps of small trees endemic to the Pampas, and this additional drain on water resources occurs early on in the plantation's life cycle – Eucalyptus plantations use more water than native grasslands shortly after being planted, and they steadily use more water until reaching four to five years of age, at which point water use continues to increase but at a slower rate (Nosetto et al., 2005; Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). In addition to the increase in water usage, tree plantations also have higher evaporative water losses than native grasslands (Nosetto et al., 2005). Eucalyptus plantations also lack the necessary ecological conditions required to provide suitable habitat for many native grassland species (Brockerhoff et al., 2008; Phifer et al., 2016). Avifauna, which provide a strong indicator of how biodiversity as a whole is faring, have been negatively affected in eucalyptus plantations in both species richness and abundance, with particularly strong effects on endemic specialist species in grassland ecosystems, which are significantly different than plantations in their natural composition (Phifer et al., 2016).

Valuation of Ecosystem Services

The valuation of ecosystem services should consider a catered, location-specific approach that is supportive and inclusive toward smallholders, allowance for production in appropriate

ecosystems, mitigation of pressure on delicate ecosystems, provision of diverse employment opportunities, land tenure security, and policy and institutional reforms that allow for sustainable resource management (Lee, 2007). Ecosystem services supply "benefits that nature provides to people, and are community or ecosystem-wide, or even landscape-wide attributes," (Petrosillo et al., 2010). Findings indicate that environmental values are not always predetermined or unchanging; instead, these values can arise from "debate, discussion, and challenge," when encountered with "new facts, insights, and judgments" supplied by others (RCEP, 1998).

The Millennium Ecosystem Assessment, an approach that considers the array of values of ecosystems and the goods and services provided by ecosystems for social well-being, places a heavy focus on economics that results in an emphasis on the monetary value provided by ecosystems (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014). Previous research conducted by Raymond et al. (2009) provides a modified version of the Millennium Ecosystem Assessment which includes the original provisioning, regulating, cultural, and supporting ecosystem services, and adds a new category, "people-related services." This added category takes into consideration human-built environments, such as plantations, and the economic effects provided by an ecosystem (Raymond et al., 2009). In addition to valuing ecosystem services like land resources, water, biodiversity, and atmospheric provisions, individuals also reported valuing the services provided by built environments and their communities; although land and water resources received the highest valuations among respondents (Raymond et al., 2009). The raw materials garnered in forestry production communities should be considered for the wood and fibers they provide. This living biomass provides physical goods for human consumption as a provisioning ecosystem service (de Groot et al., 2002; Raymond et al., 2009).

There are different perceptions of ecosystem service valuation and the decision-making process for environmental tradeoffs. The claim has been made that improved environmental quality measures are a "luxury good" only for wealthy nations that can afford to establish environmental quality practices (Lee, 2007). Attempting to study environmental and developmental tradeoffs often ends with an absence of clear, generalizable information (Lee, 2007). There are, however, identified factors that can play into environmental-economical tradeoffs, including available infrastructure and local labor markets; also of consideration are the macroeconomic environment

and sector policies, land tenure and property rights, and institutional frameworks, which all play into the outcomes of specific environment-production-livelihood regimes (Lee et al., 2001; Lee, 2007; Vosti and Reardon, 1997). What is most clear is that no single solution exists for all environmental-economic tradeoff decisions and values.

Some research has been conducted on the social valuations of ecosystem services in communities experiencing land use change via tree plantations in Uruguay (Vihervaara et al., 2012). While this work indicated overall positive attitudes among interviewed members of the general public and of experts, questions have been raised about possible conceptual and methodological problems with the analysis in the Vihervaara study (Paruelo, 2012). Previous research on local perceptions and valuations of ecosystem services in communities with tree plantations has been conducted in the study area via a traditional survey, with cognitive and emotional factors influencing perceptions (Diaz et al., 2015). No former research has been conducted in the study area that includes active engagement of participants in a deliberative process.

Public Acceptability of Tree Plantations

The success of plantation forestry is dependent upon its biological possibility, economic feasibility, and its cultural adoptability, which must be in line with accepted norms and beliefs in locations where plantations exist (Howe et al., 2005; Schirmer, 2007). Rural areas across the world with tree plantation presence are experiencing social conflict and subsequent debate alongside the increased expansion of plantations (Anderson et al., 2013; Schirmer, 2007; Williams, 2014). Public acceptability for plantations is a critical factor for public policy and natural resource decision-making (Anderson et al., 2013; Ford and Williams, 2016; Schirmer, 2007; Williams, 2014). Policy without public understanding and support is difficult to sustain (Howe et al., 2005).

Even when plantations exist on private lands, as is the case with the majority of Argentine plantations, the public is still affected by plantation operations. Specifically, forested environments are commonly viewed as a "societal good" in which activities on these private lands impact the public and their available resources (Howe et al., 2005). Plantations also compete with other land use types; acceptance is greater when plantations are placed on lands

that are not very productive or that are ecologically poor, while productive agricultural or ecologically sound environments that are converted to plantations receive less public support (Howe et al., 2005; Lockie, 2002). Concerns also expand to include the ecological viability of plantation operations, with members of the public voicing concerns surrounding negative effects on biodiversity, degraded water quality, chemical use, landscape fragmentation, and tourism issues (Schirmer & Kanowski 2001; Wilkinson et al. 2001). Community economics also come into play: rural communities with a robust economy are less likely to express concerns with plantations than communities with an economy lacking a diverse array of employment opportunities (Tonts et al., 2001).

At present, no studies have been conducted regarding the acceptability held by participants toward eucalyptus plantations in the study area.

Deliberation and Information Provision

Participation in environmental issues and related policy has become valuable and overall, participation is considered desirable; thus, the creation of more effective participation has become a focal point of study (O'Faircheallaigh, 2010; Owens, 2000; Pohjola & Tuomisto, 2011). Public participation typically follows one of two frameworks (Owens, 2000). First a rationalist, "information deficit" approach, which assumes that the general public is irrational and unaware of environmental science, aspires to engage the public by providing information in hopes of cultivating a more objective and informed populace; second, a deliberative approach focuses less on information only being supplied from those deemed to be experts, and instead encompasses more diverse understandings, allows for questioning and criticism of information, and provides an avenue for defining, identifying, and reframing problems and solutions (Bulkeley, 1999; Burgess et al., 1998; Jasanoff, 1999; Lash and Wynne, 1992; Macnaghten and Urry, 1998; Owens, 2000; Thompson and Rayner, 1998; and Wynne, 1996). While the rationalist approach intends to provide awareness to the public about environmental issues, cultivate a sense of responsibility for the issue among the public, and reach objectives, this "top-down information" can be ineffective, particularly if framing of the problem is not aligned with the public's view of the issue, if distrust of expert institutions is present, or if changes in individuals' lifestyle are needed to reach objectives (Owens, 2000). Research has implied that impediments to people taking action are not primarily focused on a lack of information or understanding; instead,

the greater obstacles deal with how problems are framed, what social and political contexts are in place, and what personal and institutional constraints are present (Owens, 2000). Unlike the rationalist approach, a deliberative approach attempts to provide democratic engagement through the creation and articulation of values, as well as in creation and execution of policy (Owens, 2000).

The use of a participatory social impact assessment (SIA), which can empower local interests and enhance participation in decision making (Craig, 1990; Lane et al., 1997; Taylor et al., 1995), provides an avenue for participant knowledge to frame community social and cultural impacts (Becker et al., 2002). Knowledge held by individuals works to identify impacts by calling on personal experiences and conceptualizations of local communities (Burningham, 1995; Chambers, 1997; Irwin, 1995; Reich, 1985). Public participation in environmental impact assessments (EIAs) and SIAs is useful due to its ability to cultivate more competent, acceptable final decisions when including both local knowledge from participants and an atmosphere where the public can examine expert knowledge, its capacity to legitimize outcomes via participants providing their stance to other members of the public and having an equal opportunity to influence decision-making, and the potential to create an environment where democratic governance is conducted appropriately (Webler et al., 1995).

The simple possession of knowledge held by community members is not sufficient on its own for effective participation in an SIA setting, however. For participants to arrive at informed judgments, a deliberative process should take place where engaged individuals exchange information in a dialectic fashion, and alternative scenarios are considered more carefully than what is experienced when members of the general public typically form perceptions (Yankelovich, 1991). One such method for providing an engaged, discursive setting is the use of an Interactive Community Forum. An Interactive Community Forum (ICF) "is a method of social impact assessment that seeks community members' judgments of social impacts resulting from project alternatives," (Becker et al., 2003). The ICF method was designed to provide an avenue to engage individual values and perspective to help shape judgments (Becker et al., 2002)

Previous research has shown that a gap exists between what individuals report a preference for regarding specific policy and what those same individuals report a preference for when provided with information on the topic and the opportunity to reflect (Fishkin, Luskin, & Jowell, 2000).

Some studies indicate that preferences and contextual values, values which depend on a particular context, are not preexisting, but instead must be formed through learning and deliberation (Christie et al., 2012; Irvine et al., 2016; Kenter et al., 2011; Parks & Gowdy, 2013; Schlapfer, 2009; Spash, 2008). The sharing of information can include the presentation of information with all ICF participants to ensure a baseline of knowledge; for example, it may be deemed necessary to provide scientific information about relevant impacts in a non-technical manner to ensure that participating community members understand the same information used by agency decision makers (Becker et al., 2002) The ICF framework defines different community roles, which participants are allowed to select based on what roles they feel they provide to the community; the assumption behind the selection of roles was that differences in local knowledge were likely to emerge among different roles, along with differences in perceived community impacts (Becker et al., 2002) The utilization of small groups in participatory assessments allows for exposure to diverse information from community members; this information can inform "perceptions and subsequent judgments," (Becker et al., 2002) A small group setting allows for the method to be truly deliberative yet representative enough to reflect society (Goodin & Dryzek, 2006). This structured group setting is critical to the participatory process as "the quality of individuals' judgments may improve through increased cognitive synthesis and increased responsibility for judgments and opinions," leading to subsequent participant responses that are more useful for decision-making and more democratic in nature (Barber, 1984; Becker et al., 2002; Echabe & Castro, 1999; Stasser & Titus, 1985).

Natural resource management is made more effective with knowledge of local social systems (Lövbrand et al., 2015). To garner a greater understanding of existing social systems, ICFs were conducted in two Argentine communities with eucalyptus plantation presence, Ubajay and La Criolla, to gain knowledge about the judgments held by community members toward the plantation forestry industry using a deliberative participatory method (Becker et al., 2003; Fishkin et al., 2000; Kenter et al., 2016). This will build upon previous work conducted in the study region that surveyed residents about their perceptions of tree plantations and their impacts toward tree plantations in Entre Ríos (Diaz et al., 2015).

The purpose of this study was to discover the effects that information provision and discourse in a deliberative, participatory setting have on judgments of eucalyptus plantations' environmental

and socioeconomic effects and acceptability for eucalyptus as a land use. Given this, the study sought to test the following hypotheses:

1. Community member judgments of environmental effects caused by eucalyptus plantations will become more negative as information about plantation effects is provided to ICF participants.
2. The acceptability of eucalyptus as a land use will decrease as more information about the effects, positive and negative, of eucalyptus as a land use is provided to participants.

Information used in this study came from the findings of the Partnerships for International Research and Education (PIRE) project entitled "OISE-PIRE: Sustainability, Ecosystem Services, and Forest-related Bioenergy Development across the Americas." This NSF-funded project has involved over 100 researchers studying bioenergy and its role and effects on ecosystem services and sustainability in six different countries in North America and South America. Research for this study has been conducted over the past five years and is currently coming to a close. This research intends to provide a comprehensive look at the results of the research team focused on one of the study countries, Argentina. The PIRE team research occurred in and around the study communities. Community members were informed of the interdisciplinary nature of the PIRE study.

Methods

Study Sites

Two communities within the Entre Ríos Province of Argentina, Ubajay and La Criolla, were selected as study sites to dissect perceptions of eucalyptus plantations among individuals living in communities containing distinct land use compositions (see Figures 1a and 1b). The two communities differ substantially in their land cover, with Ubajay's landscape being dominated by large eucalyptus plantations and La Criolla existing in a transition stage of moving away from its traditional citrus-dominated landscape to now include small and medium-scale eucalyptus plantations and other crop types (Silva et al., 2016; Silva, 2016). 45.3 percent of the land in and around Ubajay, a community of 3,507 residents as of 2010, and 37.8 percent of the land in around and around La Criolla, a community of 2,382 people as of 2010, is covered by tree plantations (Silva, 2016).

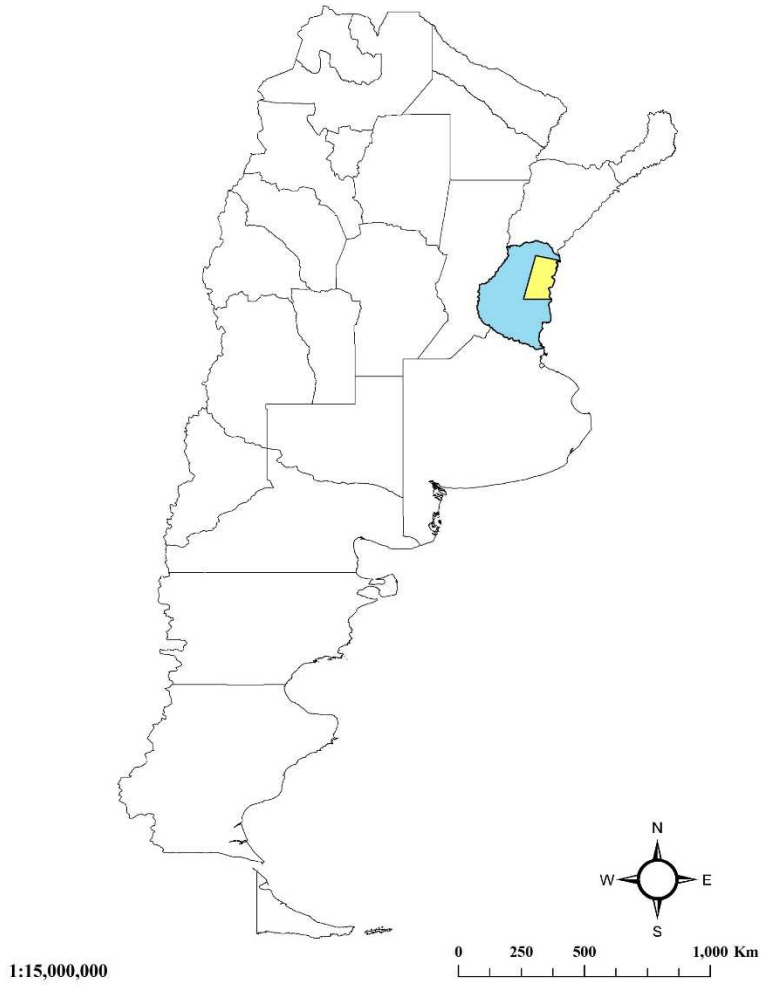

Figure 1a. Map of Argentina with the Entre Ríos province in blue; the study area within Entre Ríos is shown in yellow. Accessed from InVEST maps created by C. Phifer, 2017.

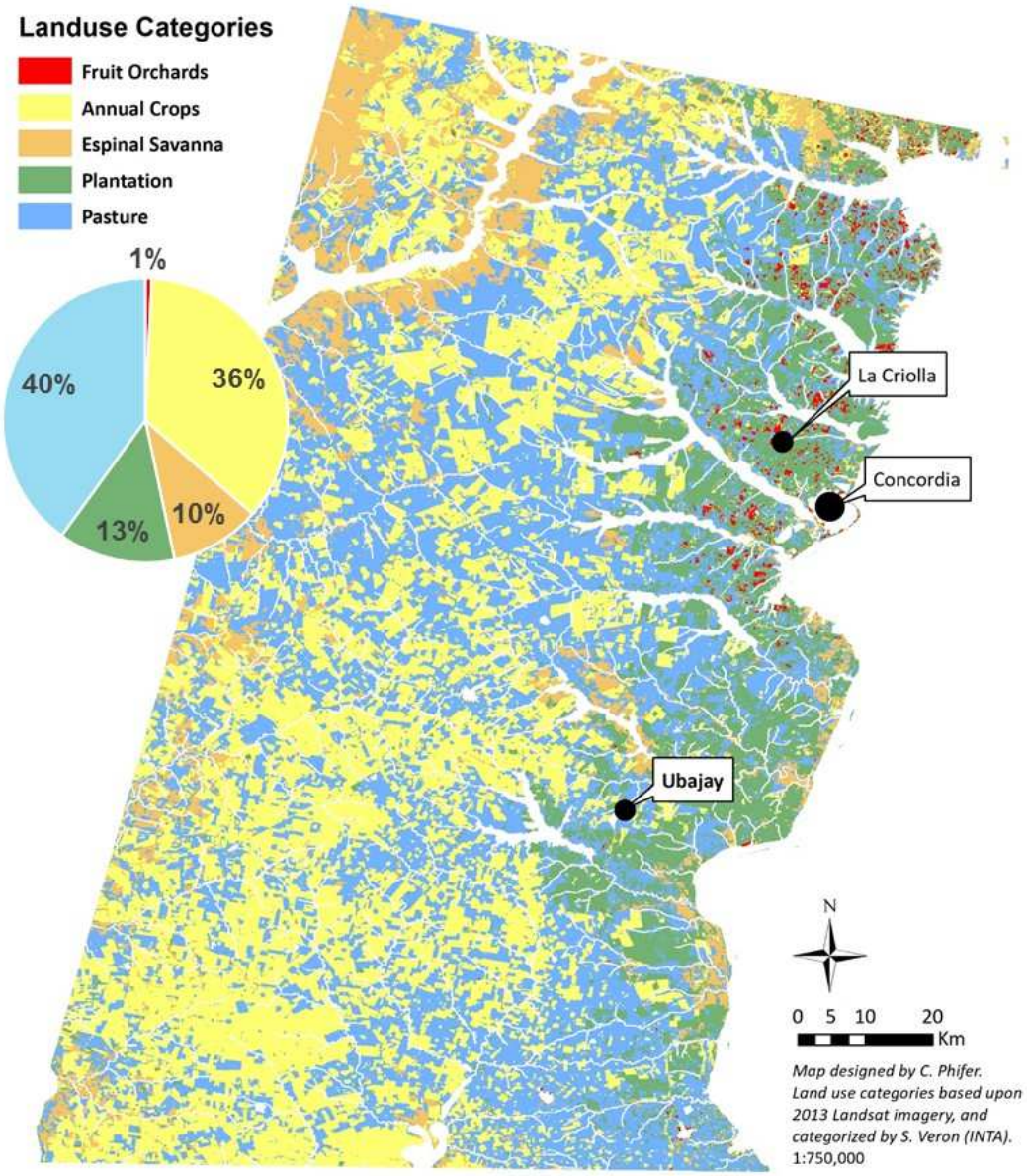

Figure 1b. Study area and surrounding region depicting land use and land cover. Accessed from InVEST maps created by C. Phifer, 2018.

Interactive Community Fora

To gain more knowledge of judgments regarding the local plantation industry, ICFs took place in December 2017 in Ubajay and La Criolla. The ICFs sought to determine community member judgments of eucalyptus plantation effects on the environment and community acceptability for eucalyptus as a land use when considering socioeconomic effects, current levels of plantation production, and potential for plantation expansion. The ICFs allowed for a participatory method of providing scientific research findings to community members and actively engaging participants in discourse and the opportunity to reevaluate judgments (Becker et al., 2003; Fishkin et al., 2000; Kenter et al., 2016). Each ICF occurred over a three-hour time period.

The ICFs provided a deliberative assembly of actively engaged community members from an array of community roles: Actively engaged community members involved in unique factions of life provide for a more diverse picture of perspectives held by community members (Becker et al., 2003; Goodin & Dryzek, 2006). Individuals who were identified in PIRE team research in prior years who were identified as actively engaged community members and who provide key roles in Ubajay and La Criolla were contacted via email and invited to participate in the fora. In addition, individuals with known experience and/or knowledge with local plantation systems were specifically targeted to ensure some members attending ICFs would have knowledge of the types of effects the research team focused on throughout research findings presentations given to the communities. Targeted individuals were asked for any additional contacts they could provide for more invitations to be dispersed to community members. In addition, the fora were open to all adult members of each community. Flyers were posted in high traffic sites throughout each community to provide optimal visibility for invitation information about the ICFs, and announcements were made on local radio stations announcing the events. A central goal of such a deliberative and inclusive participatory assessment, which comes from the desire for a "new political culture," is for participants to views themselves as "active citizens, willing, able, and equipped to have an influence in public life and with the critical capacities to weigh evidence before speaking and acting," (Advisory Group on Citizenship, 1998; Owens, 2000).

Pre-Workshop

The fora took place in a set of sessions. The first session in each community was the pre-workshop. This consisted of an introduction to the ICF and a sign-in station where participants

self-identified into their specific community roles (Table 1). Individuals who identified with differing community roles were assigned to sit at specific tables; this provided for an array of different roles at each table, which was designed to encourage a more representative and democratic atmosphere (Goodin & Dryzek, 2006). Participants also completed a short pre-workshop questionnaire. The pre-workshop questionnaire was intended to establish a baseline assessment of participants' judgments of plantations' effects on the environment, effects on socioeconomics, and acceptability of eucalyptus as a land use (see Appendix 2). Statements in the questionnaire that sought to determine participants' judgments of plantation effects on the environment and on socioeconomics were adapted from the 2014/2015 survey used in the same study communities.

Interactive Community Fora Community Roles
• Active in civic group
• Public official
• New resident
• Long-time resident
• Religious group
• Senior citizen
• Small business
• Other
• Agricultural producer
• Forestry/industrial producer
• Historical preservation
• Environmentalist
• Public health
• Young
• Education
• Farm worker

Table 1. Community roles for ICF participants, modified from Becker et al., 2003.

PIRE Research Efforts – Information Provided to Respondents

The findings presented in this paper are part of a much larger research team effort, the Partnerships for International Research and Education (PIRE) project entitled "OISE-PIRE: Sustainability, Ecosystem Services, and Forest-related Bioenergy Development across the Americas." This National Science Foundation-funded project has involved over 100 researchers

studying bioenergy and its role and effects on ecosystem services and sustainability in six different countries in North America and South America. Research for this project has been conducted over the past five years and is currently coming to a close. Interactive Community Fora were utilized to share information and test the impacts of information and discourse on judgments and acceptability of plantations. The ICF provides "a method of social impact assessment that seeks community members' judgements of social impacts resulting from project alternatives in an environmental impact assessment," (Becker et al., 2003).

Once seated, attendees were presented with findings from the PIRE research team. Plantation effects on native bird species, native pollinator species, soils, water quantity, and social survey data were presented at both fora. Overall, native bird and pollinator species, soils, and water quantity were all negatively impacted by the incorporation of eucalyptus plantations as a land use in the region. Native bird abundance and species richness declined in eucalyptus plantations, particularly in mature plantations (Phifer et al., 2016). Pollinator species diversity was substantially lower in eucalyptus plantations than species diversity found in mixed use, croplands, and livestock pastures in the study area (Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Vital soil nutrients, including soil carbon, nitrogen, calcium, and potassium, all show non-significant but declining trends in plantations between one and three rotations (Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Rotations occur every ten to twelve years (INTA, 1995). Ecohydrology results reported that young eucalyptus plantations require a large quantity of water, particularly when trees are between one and four years of age; water stress on local systems is also increased in plantations during periods of decreased precipitation (Unpublished data from Cavigliaso, Resh, Heidari, & Propato, 2017). Social data indicated that community members desire the provision of an array of ecosystem services from local landscapes, including an emphasis on the importance of clean air, clean water, adequate water quantity, as well as economic opportunities (Unpublished survey data, Silva, 2016).

In addition to the baseline scenario, the scenario depicting the landscape as is with present-day land cover, the research findings presentation session also supplied ICF participants with two predictive scenarios via InVEST models that provided visuals of the local landscape under different hypothetical scenarios. The hypothetical scenarios included: one focused on community

values, which showed a 100 percent increase in eucalyptus plantation land cover and a fifty percent increase in crops on the landscape; a mixed use scenario, which contained a 100 percent increase in plantation coverage and a fifty percent increase in mixed uses on the landscape; and a eucalyptus expansion scenario, which depicted a 200 percent increase in plantation coverage on the landscape (see Figure 2 for an example of models). A model of each scenario was created by Colin Phifer, a member of the PIRE research team, utilizing InVEST software to provide participants with an idea of what different land use decisions could look like on the landscape. Additionally, the watershed model used a doubling of forest plantation coverage to generate groundwater base flows and surface flows and discharge from a model watershed in the region. The scenario models are not intended to be predictors of future land use cover; they were designed to provide thought experiments for community members to discuss land use and land cover possibilities in Ubajay and La Criolla.

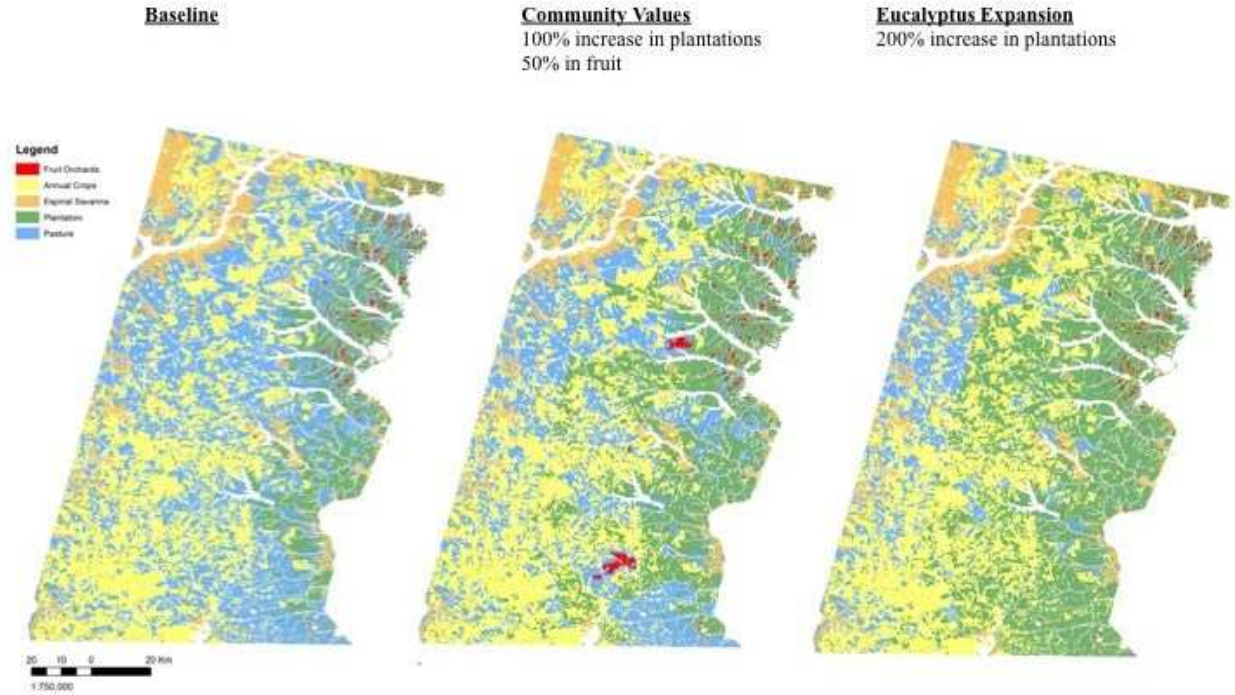

Figure 2. Land use/land cover maps depicting baseline, community values, and eucalyptus expansion scenarios. Accessed from InVEST maps created by C. Phifer, 2017.

Discussion Session

After the presentation, tables of participants completed a short series of prompts where they indicated how positively or negatively they felt that plantations affected community aspects of local people, economics, place, and vision and vitality. Participants also responded to how positively or negatively they judged plantation effects on overall community well-being. Trained facilitators present at each discussion table used a script and topics on the questionnaire to initiate and frame discussion with participants (Appendix 3). Discussion was also welcome that incorporated presented research findings and land use possibilities that could stem from the modeled InVEST scenarios. Table facilitators recorded observations from the discussions in order to have a documented description of the content of the discussions.

Post-Workshop

After the discussion period, participants were asked to complete a post-workshop questionnaire; this questionnaire was almost identical to its pre-workshop counterpart (Appendix 4). The post-test questionnaire helped to determine whether or not judgments were altered among participants after being exposed to research findings and discussion with other community members. Differences in changes in judgments from the pre-workshop to the post-workshop assessment were expected as indicated by Fishkin, Luskin, & Jowell (2000). Participants were also asked to write a short statement explaining any recommendations they had for mitigating negative effects that could be caused by eucalyptus plantation expansion.

Information presented by the PIRE team was intended to provide information about some of the topics included in the pre-workshop and post-workshop questionnaire. The environmental focal points of the presentation (impacts to native birds, native pollinators, soils, and water quantity) cover all environmental variables in the questionnaire except water quality, which was not presented. Essentially, the water quality variable acts as a control variable for environmental effects as the one category on which information was not provided to participants; thus, we expected no treatment effect for water quality in this quasi-experimental design. No change in judgments of effects was expected for this control variable. Other elements of the questionnaire relied more upon functions of discussion at the fora tables. Statements on socioeconomics in the questionnaire were not topics explicitly discussed in the PIRE presentation; however, the short pre-discussion questionnaire focused on community values aimed to initiate elements of socioeconomics in the discussion sessions. Acceptability levels for plantations at current

production levels and for expansion were also functions of discussion and of elaboration on the predictive scenarios on land use and land cover provided by the InVEST models.

The design of this ICF was adapted from Becker et al., 2003.

Pre Measure	***Treatment (Information and discussion)***	***Post measure***
Impacts		Impacts
Native birds	Avifauna impacts data	Native birds
Native pollinators	Pollinator impacts data	Native pollinators
Soils	Soil data, discussion	Soils
Water quantity	Hydrological models, discussion	Water quantity
Water quality	No treatment	Water quality
Economic opportunity	Discussion, social survey data for desired ecosystem services	Economic opportunity
Stable employment	Discussion	Stable employment
Jobs for women	Discussion	Jobs for women
Maintaining land ownership	Discussion	Maintaining land ownership
Desire to stay in community	Discussion	Desire to stay in community

Table 2. ICF study design and treatment measures for pre-workshop and post-workshop judgments of eucalyptus plantation impacts.

Pre Measure	***Treatment (Information and discussion)***	***Post measure***
Acceptability		Acceptability
Current production	PIRE research findings, InVEST baseline scenario, discussion	Current production
Expansion	InVEST projections on carbon, hydrology, pollinators, avifauna, discussion	Expansion
N/A	Discussion	Mitigation recommendations

Table 3. ICF study design and treatment measures for pre-workshop and post-workshop eucalyptus plantation acceptability.

Analysis

Demographic data, pre-workshop responses, post-workshop responses, and responses to the short community values questionnaire used to frame discussion sessions were all entered into SPSS software for quantitative analysis. Observer notes taken by facilitators during both fora were

collected and compiled to determine any themes or unique takeaway points in discussion sessions.

To test the differences between communities for judgments on impacts to the environment and changes to acceptability for eucalyptus as a land use after exposure to information from the PIRE presentation and subsequent discourse, a nonparametric Independent Samples Mann-Whitney U Test was completed for each questionnaire statement in the pre-workshop and post-workshop. Use of the Mann-Whitney U Test allowed for testing between the two communities, Ubajay and La Criolla, without requiring the assumption of normally distributed data. Qualitative data was also acquired during the post-workshop sessions for each community; at the end of the post-workshop questionnaire, participants were asked to write any suggestions they had for recommendations that could mitigate the negative effects caused by eucalyptus plantations.

Results from the fora were also analyzed by each individual community by comparing pre-workshop and post-workshop judgments and acceptability levels. Means were calculated for matched pairs: These matched sets came from individuals who responded to a questionnaire item both in the pre-workshop and the post-workshop session in their community; this eliminated responses from individuals who did not answer an item in both sessions and allowed for a direct comparison of any changes in means from pre-workshop to post-workshop. For the purposes of the statistical analysis, “don’t know” responses were excluded from means calculations. Data was also analyzed via nonparametric testing using the Wilcoxon signed-rank test. Nonparametric testing was chosen instead of parametric testing due to the small sample sizes in each community, issues with normality of data distribution, and skewed samples (samples strongly dominated by male participants in each community and one community with a large proportion of participants employed in the forestry industry).

Results

The pre-workshop and post-workshop questionnaire was a powerful tool for determining the effect of information provision on community member judgments of environmental effects from plantations and judgments on the acceptability of eucalyptus plantations as a land use. Nonparametric testing was used for these small sample populations. Overall, results indicated increasingly negative judgments for environmental impacts from eucalyptus, with La Criolla

expressing a greater magnitude of the severity of effects than respondents in Ubajay who were more resistant to acknowledge severity of impacts. Eucalyptus was considered a more acceptable land use in Ubajay than it was in La Criolla when considering socioeconomic effects and overall approval of current production and potential expansion.

Demographics of Interactive Community Fora Participants

	Ubajay	La Criolla
M Age	44.38	37.73
M Years lived in community	23.05	30.80
Gender	75.0% M	81.8% M
Income from forestry	66.7% Y	27.3% Y

Table 4. Community demographics for age, years lived in community, gender, and forestry income.

Community Roles

	Ubajay N (%)	La Criolla N (%)
Active in civic group	1 (4.2%)	1 (8.3%)
Public official	7 (29.2%)	1 (8.3%)
New resident	0 (0.0%)	0 (0.0%)
Long-time resident	0 (0.0%)	1 (8.3%)
Religious group	0 (0.0%)	0 (0.0%)
Senior citizen	0 (0.0%)	0 (0.0%)
Small business	0 (0.0%)	0 (0.0%)
Other	4 (16.7%)	6 (50.0%)
Agricultural producer	1 (4.2%)	1 (8.3%)
Forestry/industrial producer	8 (33.3%)	1 (8.3%)
Historical preservation	1 (4.2%)	0 (0.0%)
Environmentalist	3 (12.5%)	0 (0.0%)
Public health	0 (0.0%)	0 (0.0%)
Young	8 (33.3%)	3 (25.0%)
Education	6 (25.0%)	4 (33.3%)
Farm worker	4 (16.7%)	4 (33.3%)

Table 5. Number and percentage of ICF participants identified into community roles, adapted from Becker et al., 2003.

Demographic data was collected during both ICFs (Table 4). The mean age of ICF participants in Ubajay and La Criolla was approximately 44 and 38 years of age, respectively. Average years lived in Ubajay was around 23 years, while the mean years spent living in La Criolla was higher with an average of approximately 31 years. These averages for time spent living in the study

communities are strikingly similar to the PIRE survey data collected in 2014 and 2015 in each study community. The 2014/2015 survey, which utilized random sampling to ensure a representative sample of each community, found that the average years spent living in these communities was approximately 23 in Ubajay, the same as the average for ICF participants, and 29 in La Criolla, compared to the average of 31 collected from forum participants. Both community fora were heavily male dominated, with 75 percent of Ubajay's participants being male and 81.8 percent of La Criolla's participants being male. The gender breakdown was substantially different from data collected in the 2014/2015 survey: survey results showed that 43.2 percent of Ubajay respondents were male; respondents in La Criolla were 51.1 percent male. Receiving income from the forestry industry was commonplace in Ubajay, with 66.7 percent of forum participants indicating that they received earnings from forestry; forestry income was seen less frequently among La Criolla residents, with only 27.3 percent of participants indicating that they receive income from forestry. The 2014/2015 survey showed 42.2 percent of Ubajay respondents received income from sawmills or plantations, while 11.7 percent of La Criolla respondents indicated the same. Local government data for Ubajay confirms the strong economic driver of forestry, as records indicate that seventy percent of the population receives direct income from forestry (Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009). In Ubajay, common community roles as identified by ICF participants were forestry/industrial producers (33.3% of participants), young residents (33.3%), public officials (29.2%), and the education sector (25.0%); prominent community roles identified by participants in La Criolla were other (50.0%), farm workers (33.3%), education (33.3%), and young residents (25.0%) (Table 5).

Hypothesis 1: Judgements of Environmental Effects

It was expected that judgments of plantation impacts on the environment would become more negative in both Ubajay and La Criolla as exposure to information and discourse about plantation impacts on the environment increased. ICF participants were asked to provide their judgments of plantation impacts on environmental factors, including impacts to native birds, native pollinators, soils, water quantity, and water quality. Participants provided their judgments regarding these impacts during the pre-workshop and the post-workshop surveys to test for any differences in judgments after the PIRE presentation materials and subsequent table discussions.

Judgments of Environmental Impacts between Communities

No significant differences were detected between the communities' judgments of environmental effects caused by plantations in the pre-workshop (Table 6). In the post-workshop, however, Ubajay and La Criolla show clear differences in their reactions to information presented in the PIRE presentations. Mann-Whitney testing indicated that effects to native bird species were judged more negatively in the post-workshop in La Criolla (Mdn = 2) than in Ubajay (Mdn = 3, U = 19.0, p = 0.004, Table 7). The severity of environmental effects was judged significantly more negatively again by La Criolla for soils (Mdn = 2, Ubajay Mdn = 3, U = 6.5, p = 0.000) and for water quantity (La Criolla Mdn = 2, Ubajay Mdn = 3, U = 25.5, p = 0.027). No significant changes between the pre and post-workshop were found for impacts to water quality, which was expected as information on water quality was not presented in the research findings.

Pre-workshop Judgments of Environmental Effects between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)
Native bird species	4 (18)	3 (9)	71.0	0.592
Native pollinator species	4 (22)	4 (11)	110.0	0.655
Soils	3 (22)	2 (9)	66.5	0.131
Water quantity	3 (21)	4 (9)	77.0	0.404
Water quality	3 (18)	3 (6)	53.0	0.934

Table 6. Independent Samples Mann-Whitney U Test for pre-workshop judgements of environmental effects compared between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive. *No information was presented on water quality in either community.

Post-workshop Judgements of Environmental Effects between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)
Native bird species	3 (10)	2 (12)	19.0	**0.004**

Native pollinator species	3 (10)	2 (12)	43.0	0.238
Soils	3 (10)	2 (11)	6.5	**0.000**
Water quantity	3 (10)	2 (11)	25.5	**0.027**
Water quality	3 (9)	2 (10)	25.5	0.083

Table 7. Independent Samples Mann-Whitney U Test for post-workshop judgements of environmental effects compared between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive. *No information was presented on water quality to either community.

Judgments of Environmental Impacts by Community

Increased exposure to scientific information regarding environmental effects from eucalyptus plantations resulted in a more negative judgment of effects for both communities. Nonparametric paired testing was conducted via Wilcoxon signed-rank testing (Tables 8 and 9). Results indicated that after exposure to information and discourse, Ubajay's median for post-workshop judgments of native pollinator effects (Mdn = 3) were significantly more negative than pre-workshop judgments (Mdn = 4, Z = -2.050, p = 0.040, Table 8). La Criolla responses were significantly more negative in the post-workshop for effects to native birds (Mdn = 2) than in the pre-workshop (Mdn = 3, Z = -2.209, p = 0.027), with impacts to native pollinators and water quantity experiencing similar significant post-workshop decreases (Table 9). While not statistically significant, La Criolla judgments for impacts to soils were viewed more negatively in the post-workshop (Mdn = 2) to a degree that was statistically suggestive (pre-workshop Mdn = 2, Z = -1.814, p = 0.066, Table 9).

Community Judgments of Environmental Effects in Ubajay – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop N	M	Mdn.	(S.D.)	Ubajay post-workshop N	M	Mdn.	(S.D.)	Z	Sig.
Impacts on native bird species	6	2.83	4	(1.169)	6	2.67	3	(1.033)	-1.000	0.317

Impacts on native pollinator species	9	4.11	4	(1.269)	9	2.67	3	(1.581)	-2.050	**0.040**
Impacts on soils	9	3.44	3	(0.882)	9	3.11	3	(0.601)	-1.342	0.180
Impacts to water quantity	9	2.56	3	(0.726)	9	2.89	3	(0.601)	-1.732	0.083
Impacts to water quality	7	2.71	3	(0.756)	7	3.14	3	(0.378)	-1.342	0.180

Table 8. Ubajay matched pair means of judgments of environmental effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

Community Judgments of Environmental Effects in La Criolla – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop				La Criolla post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Impacts on native bird species	9	3.22	3	(0.972)	9	2.00	2	(0.500)	-2.209	**0.027**
Impacts on native pollinator species	11	3.82	4	(1.328)	11	2.00	2	(0.632)	-2.514	**0.012**
Impacts on soils	8	2.50	2	(1.069)	8	1.50	2	(0.535)	-1.814	0.066
Impacts to water quantity	9	3.22	4	(0.972)	9	2.22	2	(0.972)	-2.264	**0.024**
Impacts to water quality	5	2.80	3	(0.447)	5	2.60	2	(1.517)	-0.272	0.785

Table 9. La Criolla matched pair means of judgments of environmental effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

The majority of changes in pre-workshop and post-workshop means in Ubajay were relatively small with the exception of judgments on effects to native pollinator species, with a percent change in the mean dropping over 35 percent in the post-workshop from the pre-workshop judgments; 54.55% of respondents reported a more negative judgment for this variable in the post-workshop (Table 10). La Criolla reported much more negative means in the post-workshop in all categories except for water quality, upon which information was not presented in the PIRE presentation.

Community Judgments of Environmental Effects – Pre-Workshop to Post-Workshop Change

	Ubajay % change for M	Ubajay N change negative	La Criolla % change for M	La Criolla N change negative
Native bird species	-5.65	1	-37.89	7
Native pollinator species	-35.04	6	-47.64	8
Soils	-9.59	6	-40.00	8
Water quantity	12.89	0	-31.06	6
Water quality	15.87	0	-7.14	3

Table 10. Percent change in means from pre-workshop to post-workshop environmental effects judgments. Number of individuals in each community who changed judgments from pre-workshop to post-workshop to indicate a more negative perception (-1 to -4) was also measured for each questionnaire item.

Hypothesis 2: Acceptability of Eucalyptus as a Land Use

It was expected that the acceptability of eucalyptus as a land use would decrease as a result of increased negative judgements after the provision of scientific information. The hypothesis was tested both between communities and by community. During the pre-workshop and post-workshop, participants at each ICF were asked about their level of acceptability for plantations both at their current level of production as well as future plantation expansion. Judgments of socioeconomic effects were also considered when looking at community acceptance of eucalyptus as a land use. During the PIRE presentation, former survey data collected in the communities from residents was presented, but the economics of plantations were not specifically presented. Instead, local economics was a function of the discussions that took place during the facilitated small group discussions.

Socioeconomic Judgments between Communities

In the pre-workshop, significant differences were discovered between Ubajay and La Criolla based on responses to Ubajay's more positive judgments of plantation impacts on economic opportunity (Ubajay Mdn = 5, La Criolla Mdn = 4, U = 36.0, p = 0.000); this trend continued for stable employment and land ownership (Table 11). Significant differences were detected between communities for all five socioeconomic aspects in the post-workshop, with Ubajay providing a more positive judgment than La Criolla for every variable (Table 12).

Pre-workshop Judgments of Socioeconomic Effects between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)
Economic opportunity	5 (23)	4 (11)	36.0	**0.000**
Stable employment	5 (23)	2 (8)	23.5	**0.001**
Jobs for women	3 (23)	1 (9)	62.5	0.076
Maintaining land ownership	3 (19)	2 (9)	31.0	**0.005**
Desire to stay in the community	5 (23)	5 (10)	103.0	0.596

Table 11. Independent Samples Mann-Whitney U Test for pre-workshop judgements of environmental effects compared between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

Post-workshop Judgments of Socioeconomic Effects between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)
Economic opportunity	5 (10)	2 (12)	9.0	**0.000**
Stable employment	5 (10)	2 (11)	2.0	**0.000**
Jobs for women	4 (10)	1 (11)	9.0	**0.001**

Maintaining land ownership	3 (10)	2 (10)	24.0	**0.040**
Desire to stay in the community	5 (10)	3 (12)	26.0	**0.016**

Table 12. Independent Samples Mann-Whitney U Test for post-workshop judgments of socioeconomic effects compared between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

Judgments of Socioeconomic Impacts by Community

Differences in judgments by community on socioeconomic effects were clear, with Ubajay respondents providing more positive judgments than La Criolla. A Wilcoxon signed-ranks test indicated that La Criolla judgments of the effects on economic opportunity in the post-workshop were significantly more negative (Mdn = 2) than in the pre-workshop (Mdn = 4, Z = -1.947, p = 0.052); the same pattern followed for desire to stay in the community (Table 14). While not quite statistically significant, Ubajay's more positive judgment of the effects on jobs for women in the post-workshop when compared to the pre-workshop was statistically suggestive (Table 13), indicating a more positive judgment of the effects to female employment after the discussion session. Statistically suggestive judgments were also present for La Criolla's more negative post-workshop judgment of effects on employment stability (Table 14).

Ubajay Community Judgments of Socioeconomic Effects – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop				Ubajay post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Economic opportunities	9	4.56	5	(0.527)	9	4.78	5	(0.441)	-1.414	0.157
Stable employment	9	4.44	5	(1.014)	9	4.67	5	(0.500)	-0.816	0.414
Job opportunities for women	9	3.00	3	(0.707)	9	3.56	4	(0.726)	-1.890	0.059
Maintaining land ownership	9	3.11	3	(1.054)	9	3.33	3	(1.118)	-0.552	0.581
Desire to stay in the community	9	4.56	5	(0.527)	9	4.78	5	(0.441)	-1.414	0.157

Table 13. Ubajay matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

La Criolla Community Judgments of Socioeconomic Effects – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop				La Criolla post-workshop					
	N	M	Mdn.	(S.D.)	N	M	Mdn.	(S.D.)	Z	Sig.
Economic opportunities	11	3.27	4	(1.272)	11	2.55	2	(1.036)	-1.947	**0.052**
Stable employment	8	2.50	2	(1.414)	8	1.75	2	(0.707)	-1.857	0.063
Job opportunities for women	9	1.89	1	(1.269)	9	1.33	1	(0.500)	-1.518	0.129
Maintaining land ownership	8	2.50	2	(0.756)	8	2.13	2	(0.641)	-1.342	0.180
Desire to stay in the community	10	4.20	5	(1.033)	10	3.00	3	(1.247)	-2.070	**0.038**

Table 14. La Criolla matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Very Negative and 5 = Very Positive.

When looking at pre-workshop to post-workshop socioeconomic judgments, all post-workshop means in Ubajay experienced a positive change when compared to the pre-workshop (Table 15). In contrast, all means for La Criolla became more negative during the post-workshop (Table 15).

Community Judgments of Socioeconomic Effects – Pre-Workshop to Post-Workshop Change

	Ubajay % change for M	Ubajay N change negative	La Criolla % change for M	La Criolla N change negative
Economic opportunity	4.82	0	-22.02	5
Stable employment	5.18	1	-30.00	4
Job opportunities for women	18.67	0	-29.63	4
Maintaining land ownership	7.07	2	-14.80	2

Desire to stay in the community	4.82	0	-28.57	5

Table 15. Percent change in means from pre-workshop to post-workshop socioeconomic effects judgments. Number of individuals in each community who changed judgments from pre-workshop to post-workshop to indicate a more negative perception (-1 to -4) was also measured for each questionnaire item.

Levels of Acceptability for Plantations between Communities

In both the pre-workshop and post-workshop sessions, participants were asked to indicate their level of acceptability for eucalyptus plantations at the current production level and for expansion. A Mann-Whitney test indicated that pre-workshop acceptability of current production was greater for Ubajay (Mdn = 5) than acceptability in La Criolla (Mdn = 3, U = 37.5, p = 0.001); the same pattern occurred for acceptability of plantation expansion (Table 16). Similar findings were documented in post-workshop judgments, as Ubajay continued to have a significantly higher level of acceptability for current production and for expansion than what was reported in La Criolla (Table 17).

Pre-Workshop Acceptability for Plantations between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)
Current production	5 (24)	3 (10)	37.5	**0.001**
Expansion	4 (23)	4 (7)	36.0	**0.016**

Table 16. Independent Samples Mann-Whitney U Test for pre-workshop acceptability of current plantation production and plantation expansion between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

Post-Workshop Acceptability for Plantations between Communities

	Ubajay Median (N)	La Criolla Median (N)	Mann-Whitney U Statistic	Sig. (2-tailed)

Current production	5 (10)	2 (11)	16.0	**0.004**
Expansion	5 (10)	2 (10)	4.0	**0.000**

Table 17. Independent Samples Mann-Whitney U Test for post-workshop acceptability of current plantation production and plantation expansion between Ubajay and La Criolla. All items were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

Judgments of Plantation Approval by Community after provision of information and discussion

The ICF workshop did not result in any significant effect to the overall acceptability judgment in Ubajay. A Wilcoxon signed-rank test indicated that La Criolla's acceptability for expansion decreased significantly in the post-workshop (Mdn = 2) when compared to recorded acceptability in the pre-workshop (Mdn = 4, Z = -2.271, p = 0.023, Table 19).

Ubajay Community Levels of Acceptability for Plantations – Matched Pair Means and Wilcoxon Signed-Rank Test

	Ubajay pre-workshop N	M	Mdn.	(S.D.)	Ubajay post-workshop N	M	Mdn.	(S.D.)	Z	Sig.
Current production	10	4.50	5	(0.707)	10	4.60	5	(0.699)	-1.000	0.317
Plantation expansion	9	4.33	4	(0.707)	9	4.44	5	(0.726)	-0.577	0.564

Table 18. Ubajay matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

La Criolla Community Levels of Acceptability for Plantations – Matched Pair Means and Wilcoxon Signed-Rank Test

	La Criolla pre-workshop N	M	Mdn.	(S.D.)	La Criolla post-workshop N	M	Mdn.	(S.D.)	Z	Sig.
Current production	9	3.22	3	(1.202)	9	2.67	2	(1.500)	-1.179	0.238
Plantation expansion	7	3.14	4	(1.215)	7	2.00	2	(0.816)	-2.271	**0.023**

Table 19. La Criolla matched pair means of judgments of socioeconomic effects from plantations and Wilcoxon signed-rank test results of judgments of environmental effects. Results compare pre-workshop to post-workshop responses by community. Responses were measured on a 5-point Likert-type scale where 1 = Totally Disagree and 5 = Totally Agree.

Ubajay saw minimal changes in pre-workshop and post-workshop means for acceptability toward current plantation production and plantation expansion, while in La Criolla, both levels of acceptability decreased, with the most pronounced decrease coming from acceptability for plantation expansion (Table 20). Plantation expansion was favored 38 percent less in the post-workshop in La Criolla when compared to the pre-workshop, with every single participant providing a more negative rating in the post-workshop (Table 20).

Community Levels of Approval for Plantations – Pre-Workshop to Post-Workshop Change

	Ubajay % change for M	Ubajay N change negative	La Criolla % change for M	La Criolla N change negative
Current production	2.22	0	-17.08	5
Plantation expansion	2.54	1	-38.00	6

Table 20. Percent change in means from pre-workshop to post-workshop levels of acceptability for current plantation production and plantation expansion. Number of individuals in each community who changed level of acceptability from pre-workshop to post-workshop to indicate a more negative perception (-1 to -4) was also documented for each questionnaire item.

As sample sizes at the ICFs were small, previous survey data collected by the PIRE team was compared to ICF responses for judgments of acceptability for plantation expansion (Table 21). While means for both communities were lower among survey participants than reported means during the ICFs, the trend seen throughout the ICF was present in the questionnaire responses as well: Higher levels of acceptability were present in Ubajay than in La Criolla in both scenarios.

	Ubajay N	Ubajay M (S.D.)	La Criolla N	La Criolla M (S.D.)
Plantation expansion (Survey)	88	3.77 (1.058)	93	2.86 (1.471)
Plantation expansion (ICF)	23	4.22 (0.902)	7	3.43 (0.787)

Table 21. Mean comparison of acceptability for plantation expansion between 2014/2015 survey participants and ICF participants. Means were measured on a five-point Likert-type scale where 1 = In total disagreement and 5 = In total agreement.

Qualitative Analysis

Mitigation Recommendations

Participant suggestions for mitigating negative effects from plantation forestry at the conclusion of the post survey and during the facilitated discussion focused on three key themes: Plantation design within the landscape, economics, and knowledge and participation.

Ubajay residents provided several suggestions for modifying plantation structure as plantations commonly exist as large monocultures in the study area. One Ubajay resident suggested the use of silvopasture: "Plantations should be sparser to allow for pastures." Such a design would include the traditional land use in the community, livestock pastures. The historical land use still holds value to community members. Another Ubajay resident suggested having plantations that do not consist solely of eucalyptus: "[Provide] afforestation with different types of trees, like pine with eucalyptus." Another Ubajay resident suggested the consideration of a variety of values and impacts when planning plantation design by stating "Apply territorial ordering with integral sustainability criteria – economic, cultural, social, environmental." A La Criolla resident who suggested that plantations be "Produce[d] under certifications that guarantee the best impact," felt that certifications would diminish the likelihood of plantation design with detrimental effects.

When considering economics, residents advocated for having local economies that were not monopolized solely by the tree plantation industry. La Criolla resident suggested the "Incentiviz[ation] of other regional economies, like livestock, citrus, and horticulture."

Knowledge and participation, the critical factors behind the deliberative ICF design (Becker et al., 2003), was advocated for by ICF participants for future mitigation efforts. One Ubajay resident suggested the ""Deepening of scientific knowledge and inclusion of society in participatory politics. Generate baselines and monitor critical factors."

ICF Observations of participant discussions

The Ubajay ICF had a dominant presence of individuals from the forestry industry, including some land managers and owners, but individuals representing other community roles and interests participated as well. Newcomers to Ubajay who moved to the area for employment in forestry viewed eucalyptus plantations positively during the forum and pointed to the job security provided for Ubajay residents in the forestry industry. Some individuals working in forestry questioned the validity of the scientific data presented and in particular if there were other factors involved in soil nutrient depletion. In contrast, older residents of Ubajay and those who had spent a lifetime in the community brought up concerns regarding changes to place identity brought about by the plantation industry; population increases, changes to local culture, and changes to religious practices within the community were all mentioned as points of concern by long-time residents. One individual, a tour guide who has spent her life as an Ubajay resident, emphasized the importance of clean air and water as necessities to maintain Ubajay's culture; she felt that individuals who come to Ubajay only for work are detrimental to that environmental-cultural interface (Observation, December 12, 2017).

Overall, ICF participants in La Criolla had a much more negative view of eucalyptus plantations than the discussion in Ubajay. Discussion focused on the minimal amount of year-round employment in plantations: Participants felt that plantations only require a small amount of manual labor for the first years of plantation operations, then socioeconomic opportunities decline. Other desirable land uses were brought up, including growing blueberry crops; however, residents mentioned that the current market demand for blueberries does not make it an economically viable land use in the community. One resident shared that he had inherited a eucalyptus plantation from his father, and he stated that this was the worst thing that had ever happened to him. He said that he felt that the plantation ruined the soil, and a meager income was provided from its operation (Observation, December 13, 2017).

Discussion

Hypothesis 1: Environmental Impacts: Community member judgments of environmental effects caused by eucalyptus plantations will become more negative as information about plantation effects is provided to ICF participants.

Both Ubajay and La Criolla showed their acceptance of the knowledge imparted from the PIRE research team presentations. No significant differences existed between judgments in communities for pre-workshop responses, which was not surprising as no information on effects

had been presented and no opportunity for discourse had taken place, but both communities experienced at least some changes in judgments on environmental effects. These transformed judgments are consistent with expectations from previous research (Fishkin, Luskin, & Jowell, 2000) indicating that human judgments change when information is provided and deliberation occurs.

While both communities acknowledged negative environmental effects from eucalyptus plantations, La Criolla participants consistently judged the severity of the effects more negatively than did participants in Ubajay. This speaks to the fact that these two communities have different historical experience and different levels of intensity with the forestry industry. The institutional constraints and political contexts in the region also influences the area (Owens, 2002) via policies such as the Plantation Incentive Law (MAGyP, 2008), which has caused a rather drastic change in employment in La Criolla in recent years; Ubajay has had a lengthier exposure to the forestry industry (Silva et al., 2016). While forestry is still growing in Ubajay, it has been considered a timber town for quite some time (Silva et al., 2016). Overall, however, both communities support the hypothesis that judgments of environmental effects would become more negative as the provision of scientific information about environmental effects caused by plantations increases.

When interpreting results, a question arose: Did people change their judgments because of the scientific information they were provided with from the PIRE research team, or did judgments change because of information and interaction during the table discussions? In a way, this could be a limitation of the study; however, judgments on the effects to water quality from plantations were the only environmental factor that did not result in significant differences either when comparing responses to effects between communities for the pre-workshop and post-workshop or when comparing judgments by community for differences in pre-workshop to post-workshop responses. As effects on water quality was the only environmental aspect in the questionnaire that was not presented upon during the PIRE presentations, judgment changes about specific environmental effects appear to be more influenced by the information presented by the PIRE team than by discussion.

Hypothesis 2: Acceptability of Eucalyptus as a Land Use: The acceptability of eucalyptus as a land use will decrease as more information about the effects, positive and negative, of eucalyptus as a land use is provided to participants.

Acceptability for plantations was a function of the discussion sessions and an extension of models provided to participants: The baseline InVEST model from the PIRE presentation showed participants the present-day land cover in the study area, including plantation coverage, and the hypothetical InVEST scenario models engaged participants in thought experiments where they could visualize what plantation expansion could possibly look like on the local landscape (see Figure 2). Acceptability levels for expansion are especially relevant as federal Argentine policy continues to encourage plantation expansion in the area (MAGyP, 2008; Silva et al., 2016).

Socioeconomics play into the acceptability level of eucalyptus as a land use as the monetary value provided by ecosystem services are often a focal point for social well-being (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014). Ubajay respondents provided a positive assessment of the socioeconomic effects provided by available ecosystem services in eucalyptus plantations, even when presented with information about detrimental environmental impacts. La Criolla, in contrast, judged the socioeconomic effects of eucalyptus plantations more negatively than Ubajay. Economic benefits garnered from plantations appeared to have significant influence on perceptions of ecosystem services in Ubajay and La Criolla, with Ubajay residents being more positively influenced by plantations than La Criolla residents due to the major employment role of eucalyptus in Ubajay (Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009). While scientific information on economic effects were not directly presented to participants, socioeconomic effects were a function of discourse at the discussion tables; discussion surrounding socioeconomics and community well-being was encouraged by facilitators and through the short pre-discussion questionnaire regarding how people perceived plantation effects on local people, economics, place, and vision and vitality.

La Criolla's participants were more responsive to the information provided and subsequently provided more negative judgements of environmental impacts than what was seen among Ubajay

participants. Research has documented that social well-being derived from ecosystem services does not come exclusively from economic gain (Clayton & Myers, 2010; Zagarola et al., 2014).

Ubajay's resistance to acknowledgment of the severity of plantation impacts supports research that acknowledges the significance of the economic dimensions of ecosystem services (de Groot et al., 2002; MEA, 2005; Petrosillo, 2010; Raymond et al., 2009; Zagarola et al., 2014), as well as the importance of social and institutional constraints and the social and political context of the community (Owens, 2000). In contrast, La Criolla's support for current plantation production and increased expansion was lower than Ubajay in the pre-workshop session, and the post-workshop judgements reflected significant reduction in support for future expansion and it appears that that community members weighed multiple factors when considering plantation effects on overall well-being (Clayton and Myers, 2010). Community members in La Criolla are also operating under different constraints and contexts than what is seen in Ubajay (Owens, 2000), leading to differing approaches between communities when framing problems with plantations. La Criolla's historical land use of citriculture and its associated identity as a center for citrus production provide a different context and different constraints than what is observed Ubajay, which identifies regionally as the "wood capital," (Silva, 2016).

Thus, after being exposed to discourse and information, the forum had no statistically significant effects on acceptability in Ubajay, while La Criolla's acceptability for plantation expansion decreased significantly. La Criolla supported the hypothesis that acceptability of eucalyptus as a land use would decrease after receiving scientific information regarding eucalyptus negative effects on soils, water quantity, and biodiversity, while results from Ubajay did not support the hypothesis.

Differences seen in the employment composition in Ubajay and La Criolla shows that specialists in the forestry industry, the dominant field of employment in Ubajay, may not represent the societal values of a more diversely composed community (Zagarola et al., 2014). A community like La Criolla represents a community with a diverse economic base when compared to a forestry specialist community like Ubajay, and research has shown that specialists in a particular industry value ecosystem service factors differently than more generalist communities (Zagarola et al., 2014). Former research has shown that occupational interests can have the ability to influence landscape preferences (Yu, 1995).

Conclusion

It is clear that the presentation of research findings to community members and subsequent discussion of results and related topics did in fact alter the judgements of ICF participants. While the magnitude of change in judgments, and sometimes the direction of change in perception, were different between communities, both Ubajay and La Criolla experienced some level of documented changes in response to learning about eucalyptus plantations' effects on soil, water, and biodiversity. As indicated in previous research, the provision of information ensures a baseline of information for participants that is relevant to specific ICF topics (Becker et al., 2002), and individuals' judgments are apt to change after receiving factual information and the opportunity to reflect (Fishkin, Jowell, and Luskin, 2000). While ecosystem services provide benefits to people (MEA, 2005; Vihervaara, 2012), increased awareness about these services (via provision of findings on impacts to biodiversity presented during the PIRE presentations, for example) does not necessarily lead to an increase in valuation or appreciation for these ecosystem services (Scholte et al., 2016), however. As a land use, plantations are highly valued in Ubajay, due to the livelihood opportunities brought to community members via forestry, while La Criolla holds more negative views of eucalyptus as a land use. The willingness to make tradeoffs between environmental effects and socioeconomic benefits in favor of a forestry-dominated economy is clear in Ubajay, where the economic value provided by plantation-based ecosystem services is clearly focused upon and supported (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014). The provision of information has been shown to lack effectiveness if lifestyle changes are mandated to achieve desired objectives (Owens, 2000), as is the case with Ubajay residents showing a lack of desire to change forestry industry practices despite negative environmental effects stemming from local tree plantation operations. La Criolla has shown to be less willing to embrace the plantation industry and its effects on community well-being. La Criolla participants appeared to focus on a more holistic picture of plantation effects and acceptability that did not focus solely on economics (Clayton & Myers, 2010; Zagarola et al., 2014). It is worth noting, however, that La Criolla residents reported that they do not feel that plantations provide consistent employment opportunities, nor did they judge plantations as an economically viable source of income based on table discussions; thus, economics did play into La Criolla's assessment of the local forestry industry as well (de Groot et al., 2002; MEA, 2005; Petrosillo et al., 2010; Raymond et al., 2009;

Zagarola et al., 2014). Ultimately, the two communities hold very different judgments for what plantations can provide for future economic gain and overall social well-being.

A limitation of this study was the small sample sizes for both communities, which is a common issue with participatory research. Larger sample sizes could have allowed for a more robust statistical analysis, and a higher turnout in communities could have possibly provided the opportunity to be able to generalize the results onto the communities with more diverse participation. Participant population samples were skewed, with participant populations that were heavily male-dominated in both communities Ubajay's participant population was also skewed due to a population dominated by individuals employed in the forestry industry with interest in the plantation economy. Particularly when considering judgments of the acceptability of support for eucalyptus production and expansion, a population heavily skewed to represent the attitudes of those in the forestry industry led to skewed responses. The participant populations were not representative of the community populations as can be seen when reviewing the 2014/2015 randomized sample survey data.

Another limitation of the study focuses on the difficulty with determining whether changes to judgments and acceptability occurred because of information provided by the PIRE team, from information received from other community members during discussion, or a mixture of the two influences. Changes to judgments of environmental effects appear to be more influenced by PIRE team information due to the lack of significant changes in judgments present for the environmental control variable, water quality. Socioeconomics and their relationship to acceptability of eucalyptus as a land use appear to be most influenced by the economic structure of each community and the social constraints and contexts that exists within each community (de Groot et al., 2002; MEA, 2005; Owens, 2000; Petrosillo et al., 2010; Raymond et al., 2009; Zagarola et al., 2014), making these aspects of the ICF appear to be more reliant on the function of discussion. These results appear to indicate which element of the ICF was most influential over the two hypotheses (expert information for hypothesis 1 and deliberative participation for hypothesis 2), but it is challenging to confirm these findings with absolute certainty.

The findings of this ICF only represent the judgments and acceptability of engaged participants who took part in the December 2017 fora in two communities in the Argentine Pampas. As such,

the results of this study should not be generalized to a larger population or to other localities with plantation forestry outside of the region.

Two overarching conclusions emerged from the ICFs. First, there is clear value in moving beyond public opinion data gleaned from traditional social science methods such as surveys and interviews (Diaz et al., 2015; Silva, 2016; Silva et al., 2016); a more comprehensive picture can emerge through the engaging the public in deliberation informed by the best available science. The combination of deliberative techniques and traditional social science data collection methods can be used to allow study participants to deliberate over the aspects on which researchers desire more information (Scholte et al., 2015), resulting in more illuminating findings than traditional methods alone could provide. Second, future planning for tree plantations and plantation policy should consider the judgments held by community members living in and around tree plantations. Mitigation of negative environmental consequences stemming from plantation forestry policy should be considered to reduce environmental degradation and attenuate public concern regarding plantation practices.

References

Anderson, N. M., Williams, K. J. H., & Ford, R. M. (2013). Community perceptions of plantation forestry: The association between place meanings and social representations of a contentious rural land use. *Journal of Environmental Psychology*, 34, 121-136. doi:10.1016/j.jenvp.2013.02.001

Barber, B. (1984). *Strong democracy: Participatory politics for a new age*. Berkeley: University of California Press.

Becker, D. R., Nielsen, E. A., Harris, C. C., & McLaughlin, W. J. (2002). *Examining the effectiveness of small group dialogue in projecting the effects of EIS alternatives.* (Order No. 3050221). Available from ProQuest Dissertations & Theses Global. (305599888)

Becker, D. R., Harris, C. C., McLaughlin, W. J., & Nielsen, E. A. (2003). A participatory approach to social impact assessment: The interactive community forum. *Environmental Impact Assessment Review, 23*(3), 367-382. doi:10.1016/S0195-9255(02)00098-7,

Bremer, L., & Farley, K. (2010). Does plantation forestry restore biodiversity or create green deserts? A synthesis of the effects of land-use transitions on plant species richness. Biodiversity and Conservation, 19(14), 3893-3915. doi:10.1007/s10531-010-9936-4

Brockerhoff, E., Jactel, H., Parrotta, J., Quine, C., & Sayer, J. (2008). Plantation forests and biodiversity: Oxymoron or opportunity? *Biodiversity and Conservation, 17*(5), 925-951. doi: 10.1007/s10531-008-9380-x

Brockerhoff, E. G., Jactel, H., Parrotta, J. A., & Ferraz, S. F. B. (2013). Role of eucalypt and other planted forests in biodiversity conservation and the provision of biodiversity-related ecosystem services. *Forest Ecology and Management*, 301, 43-50. doi:10.1016/j.foreco.2012.09.018

Bulkeley, H. (1999). *Valuing the global environment: Publics, politics and participation* Retrieved from https://search.proquest.com/docview/301544861

Burgess, J., Harrison, C. M., & Filius, P. (1998). Environmental communication and the cultural politics of environmental citizenship. *Environment and Planning A, 30*(8), 1445-1460. Doi: 10.1068/a301445

Burningham, K. (1995). Attitudes, accounts and impact assessment. *The Sociological Review, 43*(1), 100-122. doi:10.1111/j.1467-954X.1995.tb02480.x

Calviño-Cancela, M., Rubido-Bará, M., & van Etten, E. J. B. (2012). Do eucalypt plantations provide habitat for native forest biodiversity? *Forest Ecology and Management*, 270, 153-162. doi:10.1016/j.foreco.2012.01.019

Carámbula, M., & Piñeiro, D. (2006). La forestación en Uruguay: Cambio demográfico y empleo en tres localidades. *Agrociencia,* 63-73.

Chambers, R. (1997). *Whose reality counts? Putting the last first*. London: Intermediate Technology Publications.

Chen, L., He, Z., Zhu, X., Du, J., Yang, J., & Li, J. (2016). Impacts of afforestation on plant diversity, soil properties, and soil organic carbon storage in a semi-arid grassland of northwestern China. *Catena*, 147, 300-307. doi:10.1016/j.catena.2016.07.009

Christie, M., Fazey, I., Cooper, R., Hyde, T., & Kenter, J. O. (2012). An evaluation of monetary and non-monetary techniques for assessing the importance of biodiversity and ecosystem services to people in countries with developing economies. *Ecological Economics, 83*, 69-80. doi:10.1016/j.ecolecon.2012.08.012

Clayton, S., & Myers, G. (2010). Conservation psychology understanding and promoting human care for nature (1st ed.). Hoboken: Wiley-Blackwell. Retrieved from http://ebookcentral.proquest.com/lib/[SITE_ID]/detail.action?docID=428230

Craig, D. (1990). Social impact assessment: Politically oriented approaches and applications. *Environmental Impact Assessment Review*, 10(1), 37-54. doi:10.1016/0195-9255(90)90005-K

Cubbage, F., Koesbandana, S., Mac Donagh, P., Rubilar, R., Balmelli, G., Olmos, V. M., de la Torre, R., Murara, M., Hoeflich, V. A., Kotze, H., Gonzalez, R., Carrero, O., Frey, G., Adams, T., Turner, J., Lord, R., Huang, J., MacIntyre, C., McGinley, K., Abt, R., & Phillips,

R. (2010). Global timber investments, wood costs, regulation, and risk. *Biomass and Bioenergy*, 34(12), 1667-1678. doi:10.1016/j.biombioe.2010.05.008

Cubbage, F., Mac Donagh, P., Sawinski Júnior, J., Rubilar, R., Donoso, P., Ferreira, A., Hoeflich, V., Olmos, V. M., Ferreira, G., Balmelli, G., Siry, J., Báez, M. N., & Alvarez, J. (2007). Timber investment returns for selected plantations and native forests in South America and the southern United States. *New Forests*, 33(3), 237-255. doi:10.1007/s11056-006-9025-4

de Groot, R. S., Wilson, M. A., & Boumans, R. M. J. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, 41(3), 393-408. doi:10.1016/S0921-8009(02)00089-7

Diaz, D., Gervasi, L., Roman, L., Vergara, L., Vergara, A. (2015). La preocupación ambiental y la actitud hacia las plantaciones forestales en comunidades de la región noreste de Entre Ríos. *XXIX Jornadas For. Entre Ríos*.

Echabe, A. E., & Castro, J. L. G. (1999). Group discussion and changes in attitudes and representations. *The Journal of Social Psychology, 139*(1), 29-43. doi:10.1080/00224549909598359

Elias, P., & Boucher, D. (2014). Planting for the future: How demand for wood products could be friendly to tropical forests. Union of Concerned Scientists.

FAO. (2006). Global forest resources assessment 2005: Progress towards sustainable forest management. Rome: Food and Agriculture Organization of the United Nations.

Fishkin, J. S., Jowell, R., & Luskin, R. L. (2000). Deliberative polling and public consultation. *Parliamentary Affairs*, 53(4) Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;query=Id:%22library/jrnart/8CT26%22

Fonseca, C., Guadagnin, D., Emer, C., Masciadri, S., Germain, P., & Zalba, S. (2013). Invasive alien plants in the Pampas grasslands: A tri-national cooperation challenge. *Biological Invasions*, 15(8), 1751-1763. doi:10.1007/s10530-013-0406-2

Ford, R. M., & Williams, K. J. H. (2016). How can social acceptability research in Australian forests inform social licence to operate? *Forestry*, 89(5), 512-524. doi:10.1093/forestry/cpv051

Gobierno de la Provincia de Entre Ríos Consejo Federal de Inversiones, 2009. Propuestas de mejora de las actividades productivas del municipio de Ubajay (Pcia. de Entre Ríos) y bases para la creación y organización de un parque industrial sectoral utilizando herramientas de producción más limpia y simbiosis industrial.

Goodin, R. E. & Dryzek, J. S. (2006). Deliberative impacts: the macro-political uptake of mini-publics. *Politics & Society,* 34(2), 219-244. doi: 10.1177/0032329206288152

Howe, G. T., Shindler, B., Cashore, B., & Hansen, E. (2005). Public influences on plantation forestry. *Journal of Forestry*, 103(2), 90-94.

Hunt, L., Bonetto, C., Marrochi, N., Scalise, A., Fanelli, S., Liess, M., Lydy, M. J., Chiu, M. C., & Resh, V. H. (2017). Species at risk (SPEAR) index indicates effects of insecticides on stream invertebrate communities in soy production regions of the Argentine Pampas. *The Science of the Total Environment,580*, 699-709. 10.1016/j.scitotenv.2016.12.016

INTA. (1995). Introducción, in: Manual para productores de eucaliptos de la Mesopotamia Argentina.

Irvine, K., O'Brien, L., Ravenscroft, N., Cooper, N., Everard, M., Fazey, I., Reed, M., & Kenter, J. O. (2016). Ecosystem services and the idea of shared values. *Ecosystem Services, 21*, 184-193. doi: doi.org/10.1016/j.ecoser.2016.07.001

Irwin, A. (1995). *Citizen science: A study of people, expertise and sustainable development*. Routledge, London: Yearley S.

Jasanoff, S. (1999). The songlines of risk. *Environmental Values, 8*(2), 135-152. doi: 10.3197/096327199129341761

Jobbágy, E. G., & Jackson, R. B. (2004). Groundwater use and salinization with grassland afforestation. *Global Change Biology*, 10(8), 1299-1312. doi:10.1111/j.1365-2486.2004.00806.x

Kenter, J. O., Jobstvogt, N., Watson, V., Irvine, K. N., Christie, M., & Bryce, R. (2016). The impact of information, value-deliberation and group-based decision-making on values for ecosystem services: Integrating deliberative monetary valuation and storytelling. *Ecosystem Services, 21*, 270-290.

Kenter, J. O., Hyde, T., Christie, M., & Fazey, I. (2011). The importance of deliberation in valuing ecosystem services in developing countries - evidence from the Solomon Islands. *Global Environmental Change, 21*, 505-521. doi: 10.1016/j.gloenvcha.2011.01.001

Lane, M. B., Ross, H., & Dale, A. P. (1997). Social impact research: Integrating the technical, political, and planning paradigms. *Human Organization*, 56(3), 302-310. doi:10.17730/humo.56.3.kg628w2t626216h0

Lash, S., & Wynne, B. (1992). Introduction. *Risk society*. London: Sage Publications.

Lockie, S. (2002). Building social capital and community well-being through plantation forestry. *Proc. of Prospects for Australian Forest Plantations 2002 Conference.* 17-27. Taylor & Francis Group, LLC.

Lee, D. R. (2007). Assessing environment-development tradeoffs: A developing country perspective. The SAGE handbook of environment and society (pp. 181-190). London: SAGE Publications Ltd. doi:10.4135/9781848607873.n12

Lee, D. R., Barrett, C. B., Hazell, P., & Southgate, D. (2001). Assessing tradeoffs and synergies among agricultural intensification, economic development and environmental goals: Conclusions and implications for policy. Tradeoffs or synergies? Agricultural intensification, economic development and the environment. Wallingford, UK: CABI Publishing. doi:10.1079/9780851994352.0451

MAGyP. (2008). Ley 25.080 generalidades.

Marini, V. (2016). The relationship between sense of place theory and perceptions of environmental, social and economic impacts of the expansion of monoculture plantations: A case study of Ubajay, Entre Ríos Province, Argentina.

MEA. (2005). Ecosystems and well-being: Biodiversity synthesis. Millennium Ecosystem Assessment. Washington, DC.

Medan, D., Torretta, J., Hodara, K., de la Fuente, E., & Montaldo, N. (2011). Effects of agriculture expansion and intensification on the vertebrate and invertebrate diversity in the Pampas of Argentina. *Biodiversity and Conservation*, 20(13), 3077-3100. doi:10.1007/s10531-011-0118-9

NGP. (2015). Argentina, plantations in grasslands. New Generation Plantations.

Nosetto, M. D., Jobbágy, E. G., & Paruelo, J. M. (2005). Land-use change and water losses: The case of grassland afforestation across a soil textural gradient in central Argentina. *Global Change Biology*, 11(7), 1101-1117. doi:10.1111/j.1365-2486.2005.00975.x

O'Faircheallaigh, C. (2010). Public participation and environmental impact assessment: Purposes, implications, and lessons for public policy making. *Environmental Impact Assessment Review, 30*(1), 19-27. doi: 10.1016/j.eiar.2009.05.001

Owens, S. (2000). 'Engaging the public': Information and deliberation in environmental policy. *Environment and Planning A, 32*(7), 1141-1148. doi:10.1068/a3330

Parks, S., & Gowdy, J. (2013). What have economists learned about valuing nature? A review essay. *Ecosystem Services, 3*, e1-e10. doi: doi.org/10.1016/j.ecoser.2012.12.002

Paruelo, J. M. (2012). Ecosystem services and tree plantations in Uruguay: A reply to Vihervaara et al. (2012). *Forest Policy and Economics, 22*, 85-88. Retrieved from DOI: 10.1016/j.forpol.2012.04.005

Payn, T., Carnus, J., Freer-Smith, P., Kimberley, M., Kollert, W., Shirong, L., Orazio, C., Rodriguez, L., Silva, L. N., & Wingfield, M. J. (2015). Changes in planted forests and future global implications. *Forest Ecology and Management*, 352, 57-67. doi: 10.1016/j.foreco.2015.06.021

Petrosillo, I., Zaccarelli, N., & Zurlini, G. (2010). Multi-scale vulnerability of natural capital in a panarchy of social–ecological landscapes. Ecological Complexity, 7(3), 359-367. doi:10.1016/j.ecocom.2010.01.001

Phifer, C. C., Knowlton, J. L., Webster, C. R., Flaspholer, D. J., & Licata, J. A. (2016). Bird community responses to afforested eucalyptus plantations in the Argentina Pampas. *Biodiversity Conservation*, 25, 1-29.

Pohjola, M. V., & Tuomisto, J. T. (2011). Openness in participation, assessment, and policy making upon issues of environment and environmental health: A review of literature and recent project results. *Environmental Health : A Global Access Science Source, 10*(1), 58. doi:10.1186/1476-069X-10-58

Raymond, C. M., Bryan, B. A., MacDonald, D. H., Cast, A., Strathearn, S., Grandgirard, A., & Kalivas, T. (2009). Mapping community values for natural capital and ecosystem services. *Ecological Economics*, 68(5), 1301-1315. doi:10.1016/j.ecolecon.2008.12.006

RCEP. (1998). *Setting environmental standards.* London: The Stationery Office.

Reich, R. B. (1985). Public administration and public deliberation: An interpretive essay. *The Yale Law Journal, 94*(7), 1617-1641

Sánchez Acosta, M. (1999). Tecnología de la madera de eucalipto en el mercosur y otros países. *XIV Jornadas for. Entre Ríos*, 1-32.

Sánchez Acosta, M., & Sepliarsky, F. (2005). Tecnología de la madera de eucaliptos colorados: Propiedades – usos – posibilidades. *I Jornadas for. Santiago Del Estero*.

Schirmer, J. (2007). Plantations and social conflict: Exploring the differences between small-scale and large-scale plantation forestry. Small-Scale Forestry, 6(1), 19-33. doi:10.1007/s11842-007-9001-7

Schirmer, J., & Kanowski, P. (2001). Avoiding snatching defeat from the jaws of victory: Plantation forestry expansion in Australia. *Proc. of Commonwealth Forestry Conference.*

Scholte, S. K. S., van Teefelen, A J A, & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics*, 114, 67-78. doi: 10.1016/j.ecolecon.2015.03.007

Scholte, S. K. S., Todorova, M., van Teefelen, A. J. A., & Verburg, P. H. (2016). Public support for wetland restoration: What is the link with ecosystem service values? *Wetlands, 36*, 467-481. doi:10.1007/s13157-016-0755-6

Silva, C. (2016). Community perceptions of ecosystem services and human well-being from tree plantations in Argentina.

Silva, C. A., Nielsen, E. A., Abrams, J., Selfa, T., & Diaz, D. (2016). Community perceptions of tree plantation effects on ecosystem services and well-being in Argentina.

Schlapfer, F. (2009). Contingent valuation: Confusions, problems, and solutions. *Ecological Economics, 68*, 1569-1571.

Spash, C. L. (2008). Deliberative monetary valuation and the evidence for a new value theory. *Land Economics, 84*, 469-488. doi: 10.3368/le.84.3.469

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*(6), 1467-1478. doi:10.1037//0022-3514.48.6.1467

Taylor, N., Bryan, H., & Goodrich, C. (1995). *Social assessment: Theory, process & techniques.* Riccarton, New Zealand: Taylor Baines & Associates.

Thompson, M., & Rayner, S. (1998). Risk and governance, part I: The discourses of climate change. *Government and Opposition, 33*(2), 139.

Tonts, M., Campbell, C., & Black, A. (2001). Socio-economic implications of farm forestry. Kingston, Australia.

Vihervaara, P., Marjokorpi, A., Kumpula, T., Walls, M., & Kamppinen, M. (2012). Ecosystem services of fast-growing tree plantations: A case study on integrating social valuations with land-use changes in Uruguay. *Forest Policy and Economics,* 14(1), 58-68. doi:10.1016/j.forpol.2011.08.008

Vosti, S. A. & Reardon, T. (1997). Sustainability, growth and poverty alleviation: A policy and agroecological perspective. Baltimore, MD.

Warman, R. (2014). Global wood production from natural forests has peaked. *Biodiversity and Conservation*, 23(5), 1063-1078. doi:10.1007/s10531-014-0633-6

Webler, T., Kastenholz, H., & Renn, O. (1995). Public participation in impact assessment: A social learning perspective. *Environmental Impact Assessment Review, 15*(5), 443-463. doi: 10.1016/0195-9255(95)00043-E

Williams, K. J. H. (2014). Public acceptance of plantation forestry: Implications for policy and practice in Australian rural landscape. *Land Use Policy*, 38, 346-354. doi:10.1016/j.landusepol.2013.11.023

Wynne, B. "May the sheep safely graze? A reflexive view of the Expert–Lay knowledge divide." (1996). *Risk, environment and modernity: Towards a new ecology* (pp. 44-83). London: SAGE Publications Ltd. doi: 10.4135/9781446221983.n3

Yankelovich, D. (1991). *Coming to public judgment: Making democracy work in a complex world.* Syracuse, NY: Syracuse University Press.

Yu, K. (1995). Cultural variations in landscape preference: Comparisons among Chinese sub-groups and Western design experts. *Landscape and Urban Planning, 32*(2), 107-126. doi: doi.org/10.1016/0169-2046(94)00188-9

Zagarola, J., Anderson, C., & Veteto, J. (2014). Perceiving Patagonia: An assessment of social values and perspectives regarding watershed ecosystem services and management in southern South America. *Environmental Management*, 53(4), 769-782. doi:10.1007/s00267-014-0237-7

Chapter 4. Conclusion

The survey data collected in Ubajay and La Criolla was used to assess socio-cultural valuation that focused on the ecosystem service values of different land uses held by individuals in both communities (Scholte et al., 2015). To develop a deeper understanding of the multiple dimensions of values held in each community, Interactive Community Fora were used as a deliberative method capable of providing a more comprehensive view of judgments toward impacts from eucalyptus plantations (Scholte et al., 2015).

When looking at the perceptions held by community members in Ubajay and La Criolla, it is clear that the impacts eucalyptus plantations have on some ecosystem services were well understood, while other ecosystem service impacts were not easily identifiable to community members. In particular, negative impacts to native avifauna and pollinators were not apparent to ICF participants before research findings were presented. The provision of additional information to participating community members during the Interactive Community Fora via presenting research findings resulted in changed judgments, as was predicted based on previous research that indicated the expected change in human judgments when given more information (Fishkin, Luskin, & Jowell, 2000). This deliberative method combined pre-workshop and post-workshop questionnaires and discussion prompts adapted from the 2014/2015 survey and information regarding community perceptions toward eucalyptus plantations gleaned from previous survey responses and in-person interviews (Silva, 2016).

Particular land use types are capable of providing certain ecosystem services, and when land use change takes place, tradeoffs occur as conversion of land use diminishes the capacity of the land to provided valued ecosystem services (Hartter, 2010; Scholte et al., 2015). Both the survey responses and responses to the ICF questionnaires showed a greater level of support for eucalyptus plantations and the economic benefits provided by them in Ubajay, while La Criolla residents were more resistant to accepting the tradeoffs that come with land use change in the form of eucalyptus plantations. While Ubajay residents acknowledged a greater level of negative impacts plantations have on the local environment at the end of their ICF after receiving expert information and the opportunity to discuss and deliberate, they were less willing than La Criolla residents to acknowledge the severity of eucalyptus plantations' impacts on the environment. It appears that Ubajay's high valuation of economic benefits outweighed, and potentially clouded,

participants' receptivity to new information. The provision of information has shown to be ineffective at getting the public to work toward objectives if this information would require a change in lifestyle (Owens, 2000). This results in Ubajay participants being more resistant to accept information depicting the severity of environmental impacts caused by eucalyptus plantations than La Criolla participants, who show greater levels of acceptance of the impacts. Instead, Ubajay residents focused on their positive judgments of socioeconomic gain they receive from the plantation forestry industry, leading to a high level of support for eucalyptus in and around the community. La Criolla participants were more willing to acknowledge the severity of impacts eucalyptus plantations have on water, soils, and biodiversity; these participants also indicated that they did not acknowledge the positive socioeconomic benefits from plantations recorded during the Ubajay ICF and showed markedly lower levels of support for eucalyptus plantation forestry. Thus, in Ubajay, study participants largely appear willing to accept tradeoffs of increased negative impacts to local water sources, soils, and biodiversity in exchange for employment in the plantation forestry industry and other sources of socioeconomic gain coming from plantations. In contrast, La Criolla residents appear to possess greater levels of environmental concern regarding the plantation forestry industry and less acceptance of tradeoffs that would involve diminishing the capability of the community's local environment to provide ecosystem services focused on water quantity and water quality, healthy soils, and native species habitat provision. La Criolla, with its lack of a strong forestry industry, does not acknowledge the socioeconomic benefits commonly identified in Ubajay, likely leading to a lower level of willingness to accept the environmental losses attached to plantation forestry as neither environmental or socioeconomic benefits are recognized in La Criolla.

The mitigation of negative impacts from plantations is a key step that must occur to keep environmental degradation from progressing further. As suggested by ICF participants, mitigation efforts should include changes to the design of future plantations that would be more sustainable than the current monoculture model. A diversified local economy not completely monopolized by the tree plantation industry could work toward mitigating detrimental economic effects as well as the potential for failed local economies in future years that are dependent on one industry. Community engagement should occur to ensure that residents are aware of plantations effects, both positive and negative. Public participation allows for engagement between community members holding different roles within local society; this engagement

allows for the consideration of a diverse array of local viewpoints on plantations and their effects.

The use of more effective, comprehensive methods for engaging members of the public with scientific information is beneficial for scientists, policy makers, and those involved in interdisciplinary work so more can be understood about the drivers of attitudes, perceptions, and judgments held by community members. Combining quantitative collection methods such as survey data with deliberative methods such as an Interactive Community Forum also clarifies the tradeoffs community members are willing to take and why those tradeoffs are acceptable to community members.

References

Fishkin, J. S., Jowell, R., & Luskin, R. L. (2000). Deliberative polling and public consultation. *Parliamentary Affairs*, 53(4) Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;query=Id:%22library/jrnart/8CT26%22

Hartter, J. (2010). Resource use and ecosystem services in a forest park landscape. *Society and Natural Resources, 23*, 207-223. doi:10.1080/08941920903360372

Scholte, S. K. S., van Teefelen, A J A, & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics*, 114, 67-78.

Silva, C. (2016). Community perceptions of ecosystem services and human well-being from tree plantations in Argentina.

List of Appendices

Appendix 1: Ecosystem Services Questionnaire, Spanish

Estamos realizando este estudio para conocer como la gente percibe los montes de eucalipto y si creen que estos montes influyen en sus vidas, la vida de su comunidad o en la naturaleza. Es una encuesta que no tomará más de 20 minutos. Se trata de preguntas relacionadas con su experiencia así como su opinión acerca de los montes de eucalipto. No es necesario que tenga conocimientos previos sobre el tema.

Este cuestionario es anónimo, y confidencial por lo que su identidad no se comparte con nadie.

Este cuestionario debe ser completado por un adulto mayor a 18 años. En el caso de haber más de una persona mayor a 18 años en su hogar, favor de completar el cuestionario aquella persona cuyo cumpleaños este más próximo a ser.

Por favor, lea las preguntas atentamente e indique sus respuestas de acuerdo con las instrucciones. Es importante que todas las preguntas tengan una respuesta. Marque su respuesta en cada pregunta.

Le voy a dejar el cuestionario a usted así lo puede completar en el momento que usted desee. Luego, yo u otra persona de mi equipo, vendrá a recogerlo dentro de ___ días. También si usted prefiere, puede entregárnoslo cuando usted la haya finalizado. Por otro lado, si usted tiene alguna duda, o quiere arreglar otro horario para entregar la encuesta, por favor contactarse con Chelsea Silva (teléfono 1160574206).

Día y hora para recoger el cuestionario: _____

Agradecemos su tiempo y buena voluntad para completar la encuesta!

Sección A: Preguntas para Empezar

1. ¿Cuántos años usted tiene viviendo en esta comunidad? _____ (número de años)
2. ¿Qué edad tiene? Marque su respuesta.

☐ 18-39

☐ 40-59

☐ 60-79

☐ 80+

☐ Prefiero no decir

Sección B: Aspectos de la Naturaleza

3. Favor de indicar su opinión acerca de la importancia de cada aspecto en **Paso 1** y luego en **Paso 2** indicar si piensa que los diferentes paisajes (montes de eucalipto y ganadería) generan estos aspectos de bienestar humano.

Paso 1: ¿Qué tan importantes son los siguientes aspectos de la naturaleza que les rodea tanto para usted como para su hogar? Indique con un círculo sólo una respuesta.						**Paso 2:** Favor de decirme si piensa que los siguientes paisajes proporcionan estos aspectos. Indique con un círculo sólo una respuesta para cada paisaje.	
Que la naturaleza…	Nada importante	Poco importante	Indiferente	Importante	Muy importante	Montes de eucalipto	Paisaje de citrus/ganadería
Sea un paisaje bonito (p.ej. vistas agradables)	1	2	3	4	5	Sí No No sé	Sí No No sé
Dé posibilidades para la recreación	1	2	3	4	5	Sí No No sé	Sí No No sé
Aporte aire limpio	1	2	3	4	5	Sí No No sé	Sí No No sé
Aporte agua limpia	1	2	3	4	5	Sí No No sé	Sí No No sé
Provea alimentos cultivados	1	2	3	4	5	Sí No No sé	Sí No No sé

Genere oportunidades económicas (p.ej. empleos)	1	2	3	4	5	Sí No No sé	Sí No No sé
Contribuya al hábitat para los aves	1	2	3	4	5	Sí No No sé	Sí No No sé
Provea gran cantidad de agua	1	2	3	4	5	Sí No No sé	Sí No No sé
Mantenga los suelos productivos	1	2	3	4	5	Sí No No sé	Sí No No sé

Sección C: Conocimiento sobre Eucalipto

4. ¿Sabía usted que los eucaliptos pueden ser una fuente de energía para producir electricidad? Marque su respuesta.

   ☐ Sí

   ☐ No

   ☐ No estoy seguro

5. ¿Sabía usted que se acaba de construir una fábrica en Concordia, que genera un producto a partir de los residuos de madera, que se utiliza en el extranjero para generar energía? Marque su respuesta.

   ☐ Sí

   ☐ No

6. ¿Qué tan importante es para usted que la energía (electricidad, calor y combustible) que utiliza sea producida en Argentina, en vez de importarla de otro país? Indique con un círculo sólo una respuesta.

Nada importante	Poco importante	Indiferente	Importante	Muy importante
1	2	3	4	5

Sección D: Producción de Eucalipto

7. La producción de eucalipto podría potencialmente modificar, tanto de manera positiva como negativa, a muchos aspectos de la naturaleza y su comunidad.

En su opinión, si hubiera una expansión del monte de eucalipto, ¿cómo evaluaría usted los cambios que esta expansión provocaría? Indique con un círculo sólo una respuesta para cada **ítem**.

CAMBIOS AMBIENTALES Y SOCIALES

Ítem	El cambio sería muy negativo	El cambio sería negativo	Neutral	El cambio sería positivo	El cambio sería muy positivo
Aire limpio	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
Hábitat para las aves	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
Prevención de las inundaciones	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
Agua limpia	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
Belleza del paisaje	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
Deseo de quedarse en su comunidad	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La capacidad de retener a la juventud en la comunidad	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺

En su opinión, si hubiera una expansión del monte de eucalipto, ¿cómo evaluaría usted los cambios que esta expansión provocaría? Indique con un círculo sólo una respuesta para cada **ítem.**

CAMBIOS ECONÓMICOS, DE PROPIEDAD, Y DE ALIMENTOS

Ítem	El cambio sería muy negativo	El cambio sería negativo	Neutral	El cambio sería positivo	El cambio sería muy positivo
La economía local	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
El número de empleos estables	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La creación de oportunidades de trabajo para mujeres	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La seguridad de los trabajadores	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La posibilidad de que la gente de su comunidad pueda mantener sus campos y no tener que venderlos	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La disponibilidad de alimentos en su comunidad	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺
La producción local de los alimentos	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺

Indique con un círculo sólo una respuesta.

	Totalmente en desacuerdo	En desacuerdo	Neutral	De acuerdo	Totalmente de acuerdo
Considerando todo, yo apoyo la expansión del monte de eucalipto	1	2	3	4	5

8. ¿Cual sería su opinión sobre la expansión del monte de eucalipto si supiera que el eucalipto se usaría para los siguientes propósitos? Indique con un círculo sólo una respuesta para cada **ítem.**

Ítem	Me opondría totalmente	Me opondría	Neutral	Apoyaría	Apoyaría totalmente
Madera quemada para producir energía en Europa	1	2	3	4	5
Madera quemada para producir energía en Argentina	1	2	3	4	5
Tablas de madera	1	2	3	4	5
Papel	1	2	3	4	5

Sección E: Valores Ambientales

9. Favor de indicar su nivel de acuerdo con las siguientes afirmaciones colocando una sola cruz en la posición del cuadrado con el que usted se sienta identificado.

Por favor mirar EJEMPLO 1 y EJEMPLO 2 para saber como expresar su nivel de acuerdo con las afirmaciones que se detallan a continuación.

EJEMPLO 1:

Boca es mi equipo preferido ☒ ☐ ☐ ☐ ☐ ☐ ☐ River es mi equipo preferido

En Ejemplo 1, el encuestado puso la cruz muy cerca del equipo de Boca porque es fanático de Boca.

EJEMPLO 2:

A continuación por favor, indique con una cruz el nivel de acuerdo colocando una sola cruz en la posición del cuadrado con el que usted se sienta identificado siguiendo el ejemplo antes mencionado para las siguientes afirmaciones.

AFIRMACIÓN 1	AFIRMACIÓN 2
Se debe dara prioridad a la protección de natauraleza aún si esto provoca un menor crecimiento económico y la pérdida de algunos empleos	Se debe dar prioridad al crecimiento económico y de empleos aún si la naturaleza sufre como consecuencia

☐ ☐ ☐ ☐ ☐ ☐ ☐

Sección F: Actitudes sobre el Cambio Climático

10. ¿Ha escuchado el término "cambio climático"? Marque su respuesta.

    ☐ Sí (pase a la pregunta 11)

    ☐ No (pase a la pregunta 12)

11. Favor de indicar su nivel de acuerdo con las siguientes afirmaciones. Indique con un círculo sólo una respuesta para cada afirmación.

Afirmación	Totalmente desacuerdo	Desacuerdo	Neutral	De acuerdo	Totalmente de acuerdo
El cambio climático causará problemas para la gente	1	2	3	4	5
El cambio climático es parte de un ciclo natural que	1	2	3	4	5

queda fuera del control humano					
El uso de la energía fósil (como el petróleo) es una de las causas principales del cambio climático	1	2	3	4	5

Sección G: Preguntas sobre Políticas Públicas

12. Favor indique con un círculo sólo una respuesta para cada **pregunta**.

Pregunta	Nada	Poco	Ni poco ni mucho	Mucho	Muchísimo
¿Hasta qué punto considera Ud. que *influyó* el gobierno en la expansión del eucalipto en su región?	1	2	3	4	5
¿Hasta qué punto considera Ud. que *debería* influir el gobierno en la promoción de la expansión del eucalipto?	1	2	3	4	5

13. Favor de indicar con un círculo su nivel de acuerdo o desacuerdo con cada **afirmación**.

Afirmación	Totalmente en desacuerdo	Desacuerdo	Neutral	De acuerdo	Totalmente de acuerdo
El gobierno hace cumplir las leyes para	1	2	3	4	5

proteger el medio ambiente en el sistema de producción del eucalipto					
El gobierno responde a las necesidades de su comunidad	1	2	3	4	5

Sección H: Preguntas acerca de Usted

14. ¿Usted o alguien de su hogar son propietarios de algún campo? Marque su respuesta.

☐ Sí (pase a la pregunta 15)

☐ No (pase a la pregunta 22)

15. ¿Cuánta superficie posee? _____ (hectáreas)

16. ¿Produce usted eucalipto en su campo? Marque su respuesta.

☐ Sí (pase a la pregunta 17)

☐ No (pase a la pregunta 18)

17. ¿Cuántas hectáreas tiene plantadas con eucalipto? _____(hectáreas)

18. ¿Ha considerado establecer una plantación de eucalipto? Marque su respuesta.

☐ Sí

☐ No

19. ¿Produce cultivos/plantaciones para alimento humano (frutas, maíz, verduras, etc.)? Marque su respuesta.

☐ Sí (pase a la pregunta 20)

☐ No (pase a la pregunta 22)

20. ¿Cuántas hectáreas están dedicadas a la producción de alimentos? _____ (hectáreas)

21. ¿Qué tipos de cultivos produce? _____

22. Género (Marque su respuesta):

☐ Masculino

☐ Femenino

☐ No contesto

23. ¿Usted tiene auto? Marque su respuesta.

☐ Sí → ¿De qué año, marca y modelo? _____

☐ No

24. ¿Algún miembro adulto de su hogar ha participado en grupos de protección o conservación ambiental?

☐ Sí

☐ No

25. ¿Cuál es su nivel máximo de estudios? Marque su respuesta.

☐ Sin educación básica

☐ Primaria no terminada

☐ Primaria terminada

☐ Secundaria no terminada

☐ Secundaria terminada

☐ Terciario incompleto

☐ Terciario completo

☐ Universitario incompleto

☐ Universitario completo

☐ Prefiero no decir

26. ¿Cómo definiría su tendencia política? Marque su respuesta.

☐ Derecha

☐ Centro derecha

☐ Centro

☐ Izquierda

☐ Centro izquierda

☐ Apartidista

☐ Otro: _____

☐ Prefiero no decir

27. Por favor indique entre los siguientes sectores, ¿cuál de estos participa en mayor medida en el ingreso de su

hogar? Marque su respuesta.

☐ Agricultura y ganadería

☐ Trabajo en aserradero

☐ Trabajo en el monte

☐ Recreación y turismo

☐ Empleo gubernamental o de servicios

☐ Otro: _____

☐ Prefiero no decir

28. ¿La encuesta le proporcionó información suficiente para responder las preguntas de manera completa y correctamente?

☐ Sí

☐ No

29. Por favor, deje un comentario acerca de la encuesta si así lo desea:

¡Gracias por sus respuestas!

Appendix 2: ICF Pre-Workshop Questionnaire, Spanish

Encuesta

1. De las siguientes opciones ¿Podría indicar si el efecto de las plantaciones de eucalipto sobre los aspectos naturales en su comunidad es positivo, negativo, o neutro?

	Muy negativo	**Negativo**	**Neutro**	**Positivo**	**Muy positivo**	**No se**
Impactos en las especies nativas de aves	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Impactos en las especies de polinizadores	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Impactos en el suelo	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Impactos en la cantidad del agua	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Impactos en la calidad del agua	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS

2. De los siguientes efectos ¿Podría indicar si el efecto de las plantaciones eucalipto sobre las características socioeconómicas en su comunidad es positivo, negativo, o nuestro?

	Muy negativo	**Negativo**	**Neutro**	**Positivo**	**Muy positivo**	**No se**

Oportunidades Económicas	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Empleo estable	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Oportunidades de trabajo para las mujeres	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Mantener la tendencia de la tierra	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
El deseo de quedarse en la comunidad	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS

3. Considerando todo, yo apoyo la producción actual de las plantaciones de eucalipto (Marque abajo su respuesta si está de acuerdo o en desacuerdo con esta declaración.)

Totalmente en descuerdo	**En descuerdo**	**Neutro**	**De acuerdo**	**Totalmente de acuerdo**
1	2	3	4	5

4. ¿Cuál es su opinión sobre la expansión de las plantaciones de eucalipto si supiera que el eucalipto se usaría para los siguientes propósitos? Indique con un círculo sólo una respuesta para cada **ítem**.

Ítem	Me opondría totalmente	Me opondría	Neutro	Apoyaría	Apoyaría totalmente
Madera quemada para producir energía en Europa	1	2	3	4	5

Madera quemada para producir energía en Argentina	1	2	3	4	5
Tablas de madera	1	2	3	4	5
Papel	1	2	3	4	5

5. Como cambaría su opinión sobre la expansión de las plantaciones de eucalipto si fuera producido …

Ítem	Mucho menos favorable	Menos favorable	Neutral	Más favorable	Mucho Más favorable
En grandes extensiones contiguas	1	2	3	4	5
En pequeñas parcelas integrado con otros usos de la tierra	1	2	3	4	5
Por inversionistas/propietarios extranjeros	1	2	3	4	5
Por propietarios de la comunidad	1	2	3	4	5
Bajo de una marca de certificación sustentable	1	2	3	4	5
Sin el uso de agroquímicos	1	2	3	4	5
Integrado con sistemas producción de	1	2	3	4	5

ganado y cultivos anuales					
Sin incentivos (e.j. subsidios forestales)	1	2	3	4	5

6. Considerando todo, yo apoyo **la expansión** de las plantaciones de eucalipto

	Totalmente en desacuerdo	En desacuerdo	Neutral	De acuerdo	Totalmente de acuerdo
	1	2	3	4	5

Appendix 3: ICF Discussion Prompt Questionnaire, Spanish

Antes de discusión grupal

7. En base de la información ya presentada, sus experiencias y conocimientos, ¿cómo evaluaría los impactos de las forestaciones actual y bajo los escenarios en su comunidad para las siguientes dimensiones?

	Muy Negativo	**Negativo**	**Poco negativo**	**Ni Negativo ni Positivo**	**Poco Positivo**	**Positivo**	**Muy Positivo**
La Gente	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
La Economía	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
Nuestro lugar	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
Visión y vitalidad	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**

8. En base de la información presentada hoy, sus experiencias y conocimientos, ¿cómo evaluaría los impactos de las forestaciones actual y bajo los escenarios al bien estar de su comunidad?

Muy Negativo	**Negativo**	**Poco negativo**	**Ni Negativo ni Positivo**	**Poco Positivo**	**Positivo**	**Muy Positivo**
-3	**-2**	**-1**	**0**	**1**	**2**	**3**

9. En base de la información presentada hoy, sus experiencias y conocimientos, ¿cómo evaluaría los impactos de las forestaciones bajo estos escenarios en el bien estar de su comunidad?

Muy Negativo	Negativo	Poco negativo	Ni Negativo ni Positivo	Poco Positivo	Positivo	Muy Positivo
-3	-2	-1	0	1	2	3

Appendix 4: ICF Post-Workshop Questionnaire, Spanish

10. De las siguientes opciones ¿Podría indicar si el efecto de las plantaciones de eucalipto sobre los aspectos naturales en su comunidad es positivo, negativo, o neutro?

	Muy negativo	Negativo	Neutro	Positivo	Muy positivo	No se
Impactos en las especies nativas de aves	-2 ☹ ☹	-1 ☹	0 😐	+ 1 ☺	+ 2 ☺ ☺	NS
Impactos en las especies de polinizadores	-2 ☹ ☹	-1 ☹	0 😐	+ 1 ☺	+ 2 ☺ ☺	NS
Impactos en el suelo	-2 ☹ ☹	-1 ☹	0 😐	+ 1 ☺	+ 2 ☺ ☺	NS
Impactos en la cantidad del agua	-2 ☹ ☹	-1 ☹	0 😐	+ 1 ☺	+ 2 ☺ ☺	NS

Impactos en la calidad del agua	-2 ☹ ☹	-1 ☹	0 😐	+ 1 ☺	+ 2 ☺ ☺	NS

11. De los siguientes efectos ¿Podría indicar si el efecto de las plantaciones de eucalipto sobre las características socioeconómicas en su comunidad es positivo, negativo, o nuestro?

	Muy negativo	**Negativo**	**Neutro**	**Positivo**	**Muy positivo**	**No se**
Oportunidades Económicas	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Empleo estable	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Oportunidades de trabajo para las mujeres	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
Mantener la tendencia de la tierra	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS
El deseo de quedarse en la comunidad	-2 ☹☹	-1 ☹	0 😐	+1 ☺	+2 ☺☺	NS

12. Considerando todo, yo apoyo la producción actual de plantaciones de eucalipto (Marque abajo su respuesta si está de acuerdo o en desacuerdo con esta declaración.)

Totalmente en descuerdo	**En descuerdo**	**Neutro**	**De acuerdo**	**Totalmente de acuerdo**
1	2	3	4	5

13. ¿Cuál es su opinión sobre la expansión de las plantaciones de eucalipto si supiera que el eucalipto se usaría para los siguientes propósitos? Indique con un círculo sólo una respuesta para cada **ítem**.

Ítem	Me opondría totalmente	Me opondría	Neutro	Apoyaría	Apoyaría totalmente
Madera quemada para producir energía en Europa	1	2	3	4	5

Madera quemada para producir energía en Argentina	1	2	3	4	5
Tablas de madera	1	2	3	4	5
Papel	1	2	3	4	5

14. Como cambaría su opinión sobre la expansión del monte de eucalipto en su comunidad si fuera producido…

Ítem	Mucho menos favorable	Menos favorable	Neutral	Más favorable	Mucho Más favorable
En grandes extensiones contiguas	1	2	3	4	5
En pequeñas parcelas integrado con otros usos de la tierra	1	2	3	4	5
Por inversionistas/ propietarios extranjeros	1	2	3	4	5
Por propietarios de la comunidad	1	2	3	4	5
Bajo de una marca de certificación sustentable	1	2	3	4	5
Sin el uso de agroquímicos	1	2	3	4	5
Integrado con sistemas producción de ganado y cultivos anuales	1	2	3	4	5

Sin incentivos (e.j. subsidios forestales)	1	2	3	4	5

15. Considerando todo, yo apoyo **la expansión** de las plantaciones de eucalipto.

Totalmente en desacuerdo	En desacuerdo	Neutral	De acuerdo	Totalmente de acuerdo
1	2	3	4	5

16. ¿Qué recomendaría para mitigar o minimizar los efectos previstos de la expansión de las plantaciones de eucalipto?

_____
_____
_____
_____